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Stone

STONE.

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TO

STONE,

VOLUME V.

WILLIAM L. SAUNDERS.

STONE

VOLUME V. JUNE, 1892. NUMBER I.

THE ROAD PROBLEM.

FIRST RUMINATION.—AS SEEN FROM THE STABLE DOOR.


"HE THAT HATH EARS TO HEAR, LET HIM HEAR."

IT WAS APRIL, the month of showers, and for several days the pelting rain had fallen in rhythmic cadence on my stable roof. The streams were swollen and the fords impassable, so that Jack and I had a rest. It was not possible even to go to mill for grist and the hay was low in the mow, but our master was a reasonable man, who knew that unless we ate neither could we work. On the day of which I speak there was a lull in the storm and it was decided to try to get in a load of hay by putting all of us to work—Jack and I were hitched to the tongue and the four bays attached to the pole as leaders. It was a desperate case and I entered a protest, but it was unavailing. After much patching of harness, we were hooked to the light hay-wagon with its narrow tires and started for Westtown, five miles distant, over a road of clay loam and mica sand. In many places the road was only a "dugout" covered with water, so that we could not see our footing, and as it was hemmed in by banks on both sides, we had no choice but to wade through the bog, mud and water, often above our knees. On reaching Crum creek we found the water chest deep on the approaches to the bridge, the floor of which was just above water, and we did not want to cross—we balked, kicked and shook our heads, but were at last driven on by curses and blows from a huge rawhide. After

much tribulation and three hours of hard work, we reached Westtown with very little energy left, yet the worst was to come. Hay was scarce and prices high because it did not pay to haul it.

Our master bought half a ton, and after getting his lunch and giving us a few handfulls of the hay, we started on our return. All went well until we reached the creek where the bottom was soft and slippery. Here Bill, one of the leaders, slipped and fell in three feet of water and got tangled up in his harness so that in a few minutes he was drowned. His traces were cut loose and his body was dragged into the stream. The rest of us struggled on sorrowfully, till after dark, stopping often to blow and shake off the mud and foam. We finally reached our stalls so late that we were not groomed nor fed. Our master was in a terrible humor because Bill was lost and estimated that that half load had cost him over two hundred dollars, and he would have to make us pay for it by going on short allowance and working harder. He was blinded by rage and did not think that it requires food to make muscle and that every pound we ate we gave back in work or fertilizers; that we were not the cause of the bad condition of the roads, and that if he preferred to have us expend our strength in the unequal contest over mud and water, we could do nothing more than protest and die in his service. We would be glad to help make the roads better if he would only let us, but there were so many people who preferred to let the roads alone in wet weather and wait till they dried out, that nothing was ever done.

Then again in midsummer, when there was not much to do, or late in the fall after the crops were in, the farmers thought it was fun to have a little political picnic on the roadside, and scrape up the mud from the ditches to the crown, and to throw the stones and rubbish into the ruts, while the county gave them credit for their taxes. If we had our way we would kick all the stones out of the earth roads and have the drains kept open all the year, while the tires of the wheels would be widened to reduce the pressure on each square inch and make the wagon act as a road preserver instead of a road destroyer.

It makes a great difference to us if we have to draw heavy loads on tires that cut through the top crust or sink into the sand and mud—we can't go so fast nor pull so much, for we are all the time trying to get on the surface, which is forever sinking under us, and our owner is paying for every inch we move, in wasted energy, money and patience. Then, again, the railroad train is idle because we cannot reach the station, and the cars are held to store goods that cannot be unloaded, while the abundant surplus of the cereal crops cannot be moved because there are not enough cars in motion. When the waterways open to navigation then the freights will be lower, though it costs no more to haul the load, and the railroads will lose a large

part of their profits because the roads were so bad that we could not haul the grain out. I often wonder why instead of building so many branch railroads, that don't pay expenses, the railroad companies don't improve some of our trunk-line highways, so we can travel them any day of the year with ease and thus stimulate local business and keep their own rolling stock in motion. I think it would prove to be a very good investment for the railroads and for the country. I can remember the festive days of the old National Pike, when the Concord and Troy stages went bowling along at the rate of ten miles an hour, including stops, and the Conestoga freight wagons rolled over the mountains to the music of their yokes of bells. The old pike with its 20 per cent. dividends paid for itself many times over, while our present earth roads have to be paid for every few years by being almost rebuilt and are even then scarcely better than a hog-wallow in many places.

It is true my reflections may not be worth much to intelligent observers, for I am but a slave, born to labor, bought for a price, and valuable only for what I can do, but I know that if my master were wise he would improve all the parts of his machine, viz.: the road, the wagon, and the motor, so as to get much more useful work out of the fuel he feeds to me. If I did not have to overcome so much gravity, cohesion and friction in the shape of grades, mud and poor construction, I could carry a much greater load in less time and with less fatigue and could save him at least one horse out of three. We would all be better fed, live longer and do more work for less money.

You may remember how Baalam beat his ass, because three times he turned aside from the obstructions in the way that he might save his rider's life; (if you do not, read Numbers xxii.) and yet even to-day our owners are so blind to their own interests and so hampered by prejudice and unwilling to trust to the native instincts with which God has endowed us, that they often force us to the wall, dump us over the bank into the river, or drive us into a quicksand or ditch; and if we refuse we are beaten almost to death with fence rails and kicked till we are sore. Why, only a few months ago, one of my friends was mired down in an innocent looking country road and before he could be supported by running rails under him he was suffocated; yet instead of draining and arching over this spot it was repaired by the country road doctor by spreading a few cornstalks over it, and called a finished job. These are facts, my reader, and I always heave a sigh of relief when I am safely within my stable walls, as you see me in the picture. These things ought not so to be. But the reform must begin at the politician, and in the meantime your memorialist must ever bray: "Work, for the night is coming."

Prof. Lewis M. Haupt, Consulting Engineer.

MODERN POWER PLANTS.

THE circumstances surrounding the growth of most American manufacturing plants, until within the last few years, have been such as to prevent the introduction of any decidedly typical plan to which others might be referred by way of comparison. As many factories were built with the expectation of using water power, steam only being added when it was found that the water was deficient in quantity during part of the year, the addition was made in such a way as merely to eke out the water suppply, and of course in such a manner as to interfere as little as possible with the principal power. Many others were started on a small scale, the original engine being first perhaps replaced by a larger one, and if the growth demanded it, others were added in such numbers as were needed and in such locations as the necessities of the case required. Of course in all such installations, while perhaps the best results attainable under the cicumstances were reached, the manner in which the various additions were forced on the proprietor prevented anything like a well conceived plan from being formed and carried out, the "plant" growing by accretion rather than development.

More recently, however, many of these successful corporations, finding their present quarters still too small, and the needed property adjoining theirs so high in price as to render its purchase undesirable, have secured new locations for their factories and consequently have erected, or are about to do so, new plants containing the latest ideas as to successful engineering practice. As the available water powers are to a large extent already in use, most new plants have to depend upon steam alone for their motive power, and so the selection of a site must be largely dependent upon ready access by either rail or water, preferably by both, thus securing the delivery of the necessary fuel at the lowest possible cost.

A plentiful supply of water for the boilers, and if possible, also for condensing purposes is also a very desirable feature of a site, and the quality of the water as to its scale-forming ingredients, or the lack of them, is also of considerable importance, although the engineer in charge is very often left to wrestle with that part of the problem after the erection of the plant, the owner generally thinking he has fulfilled his part if he provides a more or less abundant supply of water without any particular reference to its quality.

The location having been decided upon and the amount of power to be

required being known, the next question for consideration is the size of the power units, which again depends upon the construction of the factory building or buildings, which in turn is determined by the product and its method of manufacture. For instance in a flour mill where the building is generally so constructed as to have the whole process in stories piled above one another (in the larger ones to the hight of five or more stories) a single large engine is commonly employed to drive the whole of the required machinery, although very often as the grain is stored in an elevator apart from the mill building a separate smaller engine is used to do the grain handling and cleaning and is commonly so managed as to be used during the day only. In the very largest mills this system is still further extended by putting the mill machinery up in two distinct sections each with its separate engine and so arranged that each part may be operated independently of the other, thus providing a way of shutting down for repairs, or on account of the markets, without the necessity of running their engines without a regular load.

In many other industries where the same conditions prevail, that is, where the operations are such that they must all go on at the same time, and as nearly as possible at the same rate of speed, a similar system prevails, for the very good reason that the wastes in a large engine, other things being equal, are less then they would be in a number of smaller ones aggregating the same amount of power.

When the methods of manufacture are such, however, as are preferably carried on in a number of separate and distinct buildings the problem of the power plant becomes more complicated and the solution becomes largely one of compromises. When the buildings are nearly adjacent, a line shaft may be run from one to the other, an engine may be put in for each department supplied with steam from the central battery of boilers, or from an independent boiler, or some form of wire manilla rope transmission may be employed or, as in some of the more recent examples, electricity may be used as the transmitting agent. Where the amount of power required is not large and the location suitable, a line shaft is probably the most convenient method of conveyance, although it is freely admitted that the manner in which these are often put up and attended to—or rather neglected—makes them very wasteful of power.

It is doubtful if the device of a separate engine is ever to be recommended, although at least one prominent firm of engine builders seem to favor that method,but it would seem to be indefensible from the standpoint of economy of steam, which means coal, which again means money. Within certain limits rope transmission seems to offer the easiest solution for the greatest number of problems, as it can be arranged so as to drive shafts at almost any angle and at any reasonable distance, thus permitting

its use where carrying the power by a line shaft would involve too much friction and also taking it in such quantities as to render unnecessary the expense of another engine and at a comparatively small outlay. It is not to be expected that all problems to be met with in this rather intricate subject will be properly solved at the start, and there are probably many manufacturing firm, who find themselves to-day in the predicament which confronted the traveler who, inquiring his way to his destination, was told that there were two roads which he might take ; asking further as to which was the best, he was assured that whichever he took he would wish before he got through that he had taken the other!

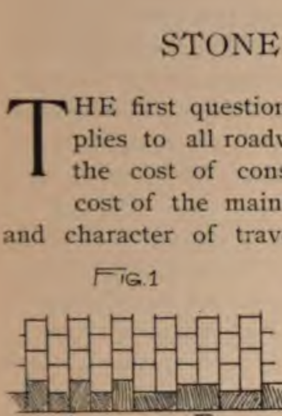
As to the latest thing in power transmission, the use of electricity, it is to be remarked, that so far as its use in factories is concerned it seems to be confined as yet to the electrical manufacturing companies themselves, largely perhaps, because of the great first cost of such power installations which of course these companies have at manufacturers' cost, while other buyers have to pay a good round profit. As these installations do not differ in principle from a number of cases in Europe where the power of waterfalls is thus carried for long distances before being used, there is no reason to doubt their capabilities from a mechanical point of view, the only question being one of comparative cost, which, reduced to its last terms, is simply whether the saving in fuel and other running expenses will pay for the greater original investment required, but until the method becomes a little more common and is in use by those who have no interest to serve in indiscriminate praise the necessary figures on which to base a comparison with other methods will not be attainable.

F. Riddell.

STONE PAVEMENTS IN EUROPE.

THE first question in building stone pavements is one which applies to all roadways; the amount of wear which it must sustain, the cost of construction, and the cost of maintenance. I put cost of the maintenance last advisedly. It should be the amount and character of travel, and the consequent cost of repairs, which determines the character of covering to be laid.

FIG. 1



A very costly pavement which will successfully stand the wear of travel and cost a minimum sum for maintenance, is cheaper than one of moderate cost which soon crushes under pressure, or needs constant and costly repairs. All pavements need constant repairs, but the cost of such attention is much less in some cases than in others.

Aside from these general considerations there are specific ones which relate to special roadways. Those influencing stone coverings are important but not numerous. They relate to the character of stone to be used, and their adaptation to street wear. Many kinds of stone have been used for street coverings, but experience has proved that some varieties possess decided advantages over others. The general custom is to use the stone which is nearest at hand—that which is cheapest, because of its nearness to the place of use. This is often poor economy. A stone which will do well with ordinary travel is not worth the cost of laying where the travel is exceptionally hard. A stone which will last in a dry climate or in sunny streets should never be laid where there are frequent rains or in narrow streets where the sun only strikes for a short time each day.

FIG. 2

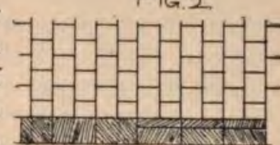


FIG 3

Thus we may divide stones according as they will stand the pressure of heavy travel, as to the slipperiness which they develop when moist, and as to the ease with which they may be worked or made into pavements. The question of cost cannot here be considered. It is too often a local consideration.

Firm sandstone possesses sufficient resistance for any but exceptionally hard wear, are readily worked into shape, thus reducing the cost for labor, and do not readily become slippery. Thus they possess excellent qualities

for road coverings. Basalt, porphyry and limestone, possess a tolerable degree of durability, but are somewhat difficult in working, because they crack readily. They also become slippery very soon. These stones are often used in city streets, and make good average pavements where the conditions of wear are simply ordinary. But even then they must not be used in places where the inclination is great because of the slipperiness which they soon acquire. The best, but at the same time highest-priced pavements, are those made of granite, quartz or syenite. These


FIG. 4

stones possess the greatest durability, and are not flattened by pressure. But the cost of working so firm a material limits their use to places where the travel is exceptional. I have given the general characteristics of the broad classes of stones as experience has shown them. However, the engineer must judge of the stones at hand by what experience dictates. Local differences in climate as well as in the rock at hand dictates what selection should be made. Such stone should be selected as will withstand pressure, without cracking; as does not attain such a degree of slipperiness as to render travel difficult or dangerous; and which can be readily worked into blocks which will fit together and insure an even surface for all time; and all this at a reasonable expenditure. The question of covering being decided, that of foundation requires serious and honest consideration. At first sight, the stonemason may think that this matter of foundation does not concern him. There is, however, no matter so vital. It is upon the foundation that the life, the smoothness and general satisfactory conditions of the the pavement depend. No amount of skill, no amount of honest endeavor, can make a lasting, satisfactory pavement if the foundation be cheap and poor. It must be remembered that there is no road covering known but will wear out. There is none but will need repairs before it has been laid many months. The very fact that the surface takes all the pressure and wear of travel necessitates its wearing out. The one part of a pavement which can be made permanent is that which lies between the top covering and the ground. Again, a firm, well-laid foundation upholds and keeps rigid the surface, thus decreasing the wear upon it, keeping it in better condition for travel and lengthening its life.


FIG. 5

I said that the foundation might be practically permanent. The cities of Europe where stone and other pavements have been laid on a poor foundation have proved that, not only must the stone covering be quickly removed, but that the foundation must be renewed. Where the proper foundation has been laid, when through the necessities of the wear the covering is worn out, it

alone is removed, and a new one laid upon the old foundation at a minimum cost for a practically new street. Thus, through the length of life of the first covering, through the generally more satisfactory state in which it remains, through the decreased cost of repairs, and because of the greatly reduced cost at which the second pavement may be made, it has been found the cheapest and best investment to lay the good foundation. The one permanent investment which can be made in street coverings is in foundations. All else is necessarily temporary. All coverings must be renewed. In the preparation of foundations for stone pavements the ground must first be prepared by giving it the same crown as the finished street is to have. It should then be carefully rolled and allowed to thoroughly dry. The general practice in German cities is to then lay first, a layer of broken stone, then one of washed gravel and finally one of cement. These foundations vary all the way from twelve to twenty inches in thickness. It is not possible to say definitely that one foundation or another is the particular one used, or the one which has received the highest commendation. Foundations of gravel and broken stone of a depth of from sixteen to twenty inches have been used in Berlin. Yet others in which concrete and broken stone have been used are by no means unknown in that city. In nearly every city we find details of differences in foundations often because of the difference in the natural bed, though at times because of a difference of opinion and differences in judgment as to what is right. However, it is well to understand that there is never any question but that the foundation should be deep and solid; that it should be unresisting. There is no division on this question. The differences are as to petty detail and not as to the general principles, which affect solidity. As long as a foundation can be made solid, enduring and uniform, the details are unimportant.

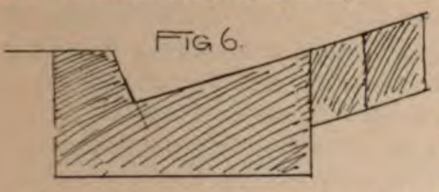


FIG 6.

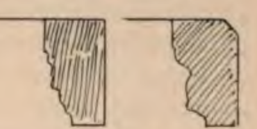


FIG 7

In Glasgow the foundations vary from seven to eight inches. Usually they are of broken stone and bitumen; or broken stone mixed with concrete which is really a broken stone concrete. Oftentimes the stone blocks are laid in and surrounded with bitumen. The reputation of any stone, no matter how well adapted to paving, will suffer if the foundation be not strong. The public does not see below the surface. If the foundation is bad, the people, seeing only the top stone say: "Give us no more of it. It is a bad covering."

There is not a little to be said on the subject of curbings. This seems the

part of a street which requires the least consideration. Yet the engineers in Germany, Holland, France and Scotland give this matter serious, rational consideration. In many cities in the countries named comparatively few high curbs, such as are almost universal here, are found. The necessary strength which a curb gives to the side of the roadway is added to by a surface which is perfectly smooth. Fig. 1, shows how this is done. The shaded parts indicate what, for want of a better name, we must call the curb stones. The Germans have a specific name for this kind of protection to the edge of streets. These stones are about thirteen inches in thickness, and thus sink deeply enough into the foundation to insure strength to the edges. A and B, in Fig. 1, show the better methods of laying these stones so that they bind the pavement the most strongly. C and D in Fig. 2, are faulty, first, because they do not bind the pavement well, and because the wheels of vehicles driving lengthwise readily moves them from place, causing a decided defect in the pavement.

Four methods of laying high curbs is shown in Figs. 3, 4, 5 and 6. The height above the roadway of the curb-stones should not be greater than eight inches, because of the difficulty of stepping from the street to the pavement when they are higher. More than one accident has occurred in slippery times through the inability of a foot passenger to step over high curbs. The stones should sink into the foundation not less than ten inches below the surface of the covering. The reason is obvious. Fig. 3 shows a very common method of laying pavement up to the curb. Fig. 4, shows one much better, perhaps the best known. Figs. 5 and 6 give two of kindred forms which have been used abroad, just why is not obvious, unless because of added beauty. The first cost is much greater, and they have been found to so readily loosen through the pressure of vehicles that their use is almost entirely prohibited by city governments in Germany. Fig. 7, gives accepted forms of curb-stones before laying.

All curb-stones should be close-fitting at the top for from one-half to one-third their depth. Below that there should be slight crevices left between the stones that any water which may get into foundation may be readily run away.

Louis H. Gibson.

WEATHERSFIELD'S RESOURCES.

"And lavish Nature, wondrous in her might,
Gave of her best and set no outward bounds."

READERS of STONE have been told of the wondrous natural resources of mineral wealth which only await development all over Vermont, and incidentally individual towns have here and there been alluded to as furnishing examples of the golden opportunities which await the capitalist who will apply his means to the development of these re sources. Conspicuous among the towns thus favored stands Rutland, the greatest marble producing city, or the center of the greatest marble producing region of the world; and Barre, that phenomenal wonder among New England towns as regards its growth during the past two decades. They have succeeded because capital has been attracted, and on the principle that like attracts like, after a town has a start, it is comparatively easy for it to climb rapidly the grade of development and prosperity.

But leaving those towns for the present which have such a past behind them and a future which will surpass even the rosiest dreams of their most sanguine admirers, we find a larger number of Vermont towns, which, as yet have had no recognition, and are struggling along toward the development and the utilization of material resources lavished upon them by nature when the foundations of the world were laid. The past few years has seen more of such towns coming to the front than in the hundred years which have preceded, and the next few years will see a development of such towns in Vermont which will astonish the boomers of Fort Payne and New England City in the South.

Windsor county has always been looked upon as a bed of mineral wealth and standing up near the head of the twenty-four towns is Weathersfield, situated in the southeastern part, bordered by the Connecticut river on the east and bounded on the north by the mountain and foot hills of Ascutney, 3,320 feet high. The town forty years ago was one of the principal manufacturing centers of the state and the five villages were busy hives of industry. It is cut in two near the western border by Black river which furnishes numerous valuable water-powers of sufficient strength to turn the wheels of almost any sized manufactory one might wish to build. A few only are utilized and those remaining vacant are enough for all the requirements of manufactories that may come.

The town is divided into several sections by high hills and it is in these

hills that one is most interested at present. In their bosoms lie resources, which if developed would make Weathersfield another Barre and put all of her citizens above the necessity of daily work. In a small degree these resources are being developed and as the demand for products of the quarries increases there is every reason to suppose that the resources here lying idle will be taken from their hiding and used for man's comfort.

Numerous causes have conspired to prevent this. Of only two of which is it necessary to speak—first lack of knowledge concerning the value of the rock beneath the surface and second the lack of railroad facilities to furnish adequate transportation without using all the profits in hauling by team. Both of these causes are now removed, or will be soon. A sufficient knowledge of the value of the deposits is now prevalent and a railroad has been surveyed which will connect the town with two important systems having terminals in Boston and New York. When that road is built the objection to undertaking to work the quarries extensively will be past and development will be as rapid as that of Barre or Rutland. The quarries are equally exhaustless and capital will be equally plentiful.

The survey for the railroad from Cavendish enters the town near Black river and follows it to the village of Lower Perkinsville thence down to the Springfield line and on to the village of Springfield, giving Weathersfield about five or six miles of road within its limits. This will be somewhat augmented by side-tracks as they are needed and the equipment will include all the facilities which make economical railroading possible. Some idea of the value of the mineral deposits may be gathered from the engineers' report after making a careful survey for the road. The total traffic after building will pay the interest on one million dollars at 6 per cent. Of this Weathersfield will furnish 2 per cent. The opportunities for future development are such that the new line, as surveyed, with a total length of 29 miles, will develop more traffic in freight than the entire Rutland railroad, with a length of 119 miles, excluding the villages of Rutland and Bellows Falls. To build this road the town of Springfield has guaranteed aid in the sum of $40,000 and Weathersfield has voted $15,000, when the road shall be built and trains running through the town. Individual subscriptions bring the total up to nearly $100,000, and New York capitalists have agreed to guarantee the remainder of the $495,000, necessary to put the road in shape and set trains in motion. Some technicalities yet remain to be settled and then work will immediately begin. It is expected that everything will be ready in two years from the time work is begun.

The mineral resources of the town comprise unlimited deposits of workable gneiss and granite in Ascutney mountain; vast quantities of cement limestone at Amsden; granite on Pine Hill; granite, marble and limestone on Hawks' mountain and soapstone, which for some purposes has no

known equal. To speak of all of these deposits as unlimited really conveys but little idea of the enormous amounts represented. Ascutney mountain is more than 3,000 feet high. The line between Weathersfield and Windsor goes over the top of it, leaving one-half, or a little less, in Weathersfield. The granite on the surface gives abundant evidence of the value of the stone underneath. The Windsor side has been worked somewhat and now a company is preparing for extensive operations as soon as roads can be built and the preparations for economical labor completed. There are three colors of stone. One is a light gray, something similar to the light gray Barre stone and not materially unlike specimens taken from the Quincy quarries. Another variety is green, appearing in the arrangement of its colors something like a moss-agate, and the third variety is a beautiful pink shade varying in tone from light to dark. All these colors can be found within easy working distance of the surface and are all valuable for particular purposes. The gneiss which surrounds the granite and comprises a larger part of the formation of the mountain is good for building stone and has been utilized for that purpose to some extent. The development so far has been largely on the Windsor side, bnt there are indications that the Weathersfield side will be opened before long, especially since it has been decided that a railroad is coming.

At Amsden is a whole village founded on lime. Hon. Charles Amsden, the owner, has built up the village and business from almost nothing, since he was seventeen years old. He and his father-in-law began the burning of cement lime there forty or more years ago and from that small beginning has grown a village of scores of inhabitants, all working in the quarries and engaged in accessory occupations. Mr. Amsden burns his lime in two improved Sherman kilns and his output is from 12,000 to 15,000 barrels a year. The deposits where he has worked for years are in a hill just back of the village and show no sign of being exhausted. A new industry has been added since the introduction of paper making by chemical process—the shipping of rough rock to be used in sulphite mills. The only thing to retard this part of the enterprise has been the lack of transportation facilities which will soon be overcome.

Mr. Amsden has no monopoly of ownership of limestone ledges just as suitable for cement lime as the ones first opened. All up and down the range of hills in which his quarries are situated are out-croppings which have no limit and constantly grow better as lower depths are reached. On the southern extremity of Pine Hill, a curious geological formation near the western side of the town, there was formerly some ledges worked to a limited extent, but have been abandoned for years. The stone is a beautiful white color and takes a polish not unlike marble. The entire hill is full of limestone, and, being near the surveyed railroad, it will be developed

shortly. It would not surprise those who have examined the rock if a good quality of marble was found at no great depth below the surface. Across Black river one finds enormous deposits of limestone on the eastern slope of Hawks' mountain, a portion of them being only a few rods from the railroad. In connection with it is found a stone, which from surface indications, and a survey made with powder a short time ago, seems to be marble. The color is white, sometimes shading into pinks and blues. A polished specimen shows as much intrinsic beauty as much of the Rutland marble used for monumental work. The bits lying about on the ground weather well and do not discolor badly. The ledges are owned by Mr. Charles D. Walker, who apparently has a fortune in his mountain pasture, previously thought of little value excepting for the maintenance of sheep. Besides this there are untold quantities of good building and flagging stone and all is within 15 rods of the proposed railroad line. Few such deposits are found even in Weathersfield.

Following the river up from here one comes to Upper Falls, an unused water-power owned by the Call Manufacturing Company, of Perkinsville. Not far from it on the northern slope of Hawks' mountain are immense deposits of lime and in years past lime kilns were built not far from the power and lime burned to some extent. It has long been idle, however, and the kilns are in ruins. The whole northern side of the mountain is a mass of lime. At least such is the case where the stone has been denuded. Fortunes await those who will develop the resources which have lain so long concealed.

At Perkinsville are the soapstone quarries the annual output of which is one of the great products of Weathersfield. These quarries are owned by Gen. Charles Williams, of Manchester, N. H., the largest dealer in soapstone in the world. There are two quarries, the larger one situated just over the line in Baltimore and the smaller one a short distance down the hill in Weathersfield. Only the upper one is worked. There is but little question that both are in the same bed, though the upper quarry produces by far the best stone, especially for fire purposes. A large gang of men is employed and the rough blocks are carted by team to the village a mile or so down the hill, where there are two mills in which it is sawed into slabs, a larger portion of which are shipped to the main works at Nashua, N. H. A part of the stone is worked up into articles for domestic use comprising sinks, stationary wash and bath-tubs and such other articles as are useful in the domestic economy of the household. A generation ago Hyren Henry manufactured soapstone stoves in one of the shops and such stoves are made to his day. The manufactory is not in this town, however, though some work is done in that department. The works are to be largely increased as soon as the railroad is built. H. H. Hicks, the superintendent

of the business is a live man and leaves no scheme untried which is for the benefit of the business or enhances the welfare of the town.

The water power at Perkinsville and near it is unlimited. The only mills now running are the soapstone shops before alluded to, the Call Manufacturing Company's mill, cotton goods, and M. G. Robinson's chair stock mill at Lower Perkinsville. There are numerous privileges ready to be utilized as soon as development shall warrant it. The Call Manufacturing Company is managed by E. I. Call, a young man of push and energy, who will answer all inquiries relating to the town and show you around if you visit the place.

For building purposes lumber of all sorts is plenty and cheap. In making the survey for the railroad the engineers found in one place pine trees more than four feet in diameter at the base, which under the present condition of transportation are not worth cutting and hauling from the lots where they stand. The hills and mountains are covered with valuable timber and building material would be easily and economically produced as soon as wanted and in such quantities as are needed.

Apart from the knowledge to be gained of the vast mineral resources awaiting development, the west side of the town is one of the most picturesque in Vermont. Mountains and hills cut it up into all sorts of fantastic shapes, giving diversified scenery which never fails to attract visitors a second time. Mountain and meadow, hill and vale, all are charming and all inviting. The material development which is coming as this vast wealth becomes known, will not be injured by the attractiveness of the scenery among which the manufacturers and workmen must make their homes. Churches, schools and social life in general is of the best class of the older Puritan type, modified by modern systems of thought and living. The little villages seem like small paradises nestled among the hills, often overshadowed by high mountains as is the case with Ascutneyville, which is built close under the mountain whose name it bears. Another form of village is seen at Weathersfield where the houses are built on the immense meadows which stretch north and south along the Connecticut. Perched high on the hills, two thousand feet above sea level is the little hamlet of Weathersfield Center, a place where all the kingdoms of the earth seem to lie almost at one's feet. Amsden has been mentioned and Perkinsville also. Each has attractions which will commend it to different tastes.

Of the farmers it is said that they are more than ordinarily prosperous and enjoy the benefits of the good things of this life more than their cousins in other parts of the country. The land, like all lime land, is extraordinarily fertile and produces abundant crops each year. A very much larger manufacturing population could be easily supported and the farming portion of the community hope soon to see their mineral wealth

utilized more than it is. To encourage those who want to build up industries they exempt from taxation for a term of years and do other things which will help. Then they will have a larger home market for surplus agricultural products, making long journeys to distant manufacturing towns less necessary, and consequently, the marketing of salable products less costly than at present.

Such is the present of Weathersfield and such is the glimmering of the brilliant future just dawning when the railroad shall be finished and the costly transportation problem forever solved.

Burton H. Allbee.

THE STONE WALL.

PEOPLE who have seen many of the wonders of Colorado consider the natural stone wall, from which Stonewall takes its name, as one of the most interesting. Broken and irregular, it yet may be traced for a hundred miles. In some places, it runs up to a point 150 feet perpendicular on one side, while on the other there is a slope not difficult to climb. From the top of one of these points, on a clear day, the view is fine. Besides the valleys and meadows and lakes close at hand, you may see the Sangre de Christo range to the west, always covered with snow; the symmetrical Spanish peaks, about twenty miles to the north, and Fisher's Peak, of the Raton range, forty miles to the east, looking like a few great blocks laid carelessly on top of each other.

Looking down, you will notice that the wall seems to be a dividing line, as on the west side the rocks and soil are of a reddish color, while on the east the rocks are a light grey and the soil black. In the crevices of the wall, little birds build their nests, owls live and hoot and vines and small pines and cedars somehow find a footing. At its foot, in one place, a spring oozes out strongly scented with sulphur and tasting too nasty for description.

From the top of the Spanish Peaks, many of these rock walls may be seen, centering at the peaks and diverging in every direction. It gives one the idea that they may, at one time, have run down from these mountains in a melted state, especially as they show an igneous origin, and there is a trace of an ancient crater on top of the east peak. Yet our local geologist tells us that these walls were thrown up through the strata as they stand. *Quien Sabe.* A little gold and silver is found in places in the walls, while in the Spanish Peaks are several paying mines.—*K. L. C. in Great Divide.*

THE SITE OF C. E. TAYNTOR & CO.'S COVERED QUARRY AT BARRE, VERMONT.

BIG GRANITE QUARRYING.

GRANITE, since the days of the Pyramids, has been sought for building and monumental purposes. Strong in its resistance to pressure, beautiful to the eye, and proof against the destructive inroads of time, granite has no equal. Among stones it has a wider application than any other product of quarries, and is better known, more largely used, and more durable than any other.

The word granite is a popular not a scientific term, and it applies to stone which is as varying in its appearance as in its chemical composition. The word is derived from "granum," the Latin for a grain, which is significant of its granular appearance and structure. It invariably contains quartz which seem to have been thoroughly shaken up and mixed with feldspar, mica, hornblende, etc. It is interesting to notice that the quartz in granite, though appearing solid, is spongy, containing small cavities which are usually filled with water or various salts. The microscope sometimes shows a small bubble like that in a spirit-level, this being composed of carbonic acid confined in a small chamber. It has been estimated than one cubic inch of space contains about five thousand millions of these cavities.

Granite has been called the noble rock. It is the foundation stone of the New England States and is quite as conspicuous along the coast as it is among the hills, through the streets and in the cemeteries. The Obelisk in Central Park is a sample of granite quarried on the banks of the Nile. The Bunker Hill monument was built of granite from Quincy. The postoffice

and the Equitable building of New York, and the navy department building in Washington, are samples of granite for building purposes, while the polished stairway in the new city hall building in Philadelphia, and the tombs and monuments which have during recent years so largely replaced marble in the cemeteries, are evidences of the value and beauty of ornamental granite.

It was not until granite came into general use for ornamental purposes that the finer deposits were worked. The granites of Maine, Massachusetts and New Hampshire are mostly coarse in grain, and are especially suited for building purposes. Much fine ornamental work in granite is done at Quincy, but for uniformity of structure, fineness of grain, richness of color and beauty the Barre, Vermont, granite has no equal.

The Barre granite territory is situated a short distance from Montpelier, Vermont, and is about one and one-half miles in length and width. The stone is laid in sheets varying in thickness from a few inches to ten feet or more, and is practically inexhaustible. Sound and marketable from the very crust of the surface the quarries have always been profitable investments.

As a granite producing state Vermont held no position at the time of the tenth census. But three quarries are mentioned, and the entire product of the state was only a little over $59,000 per annum, while in the eleventh census, ten years later, it is given at more than half a million dollars. As an evidence of the growth of the granite industry the census of 1889 gives the value of the granite output at $14,464,000, while in 1880 it was only about $5,000,000, an increase of over $9,000,000, or 197 per cent.

The greatest granite-producing state is Massachusetts, followed by Maine, California, Connecticut and Rhode Island. Vermont stands ninth in the list. Vermont produces but little granite for building purposes. Massachusetts is far in advance of other states in this line. In street work, paving, etc., Maine takes the lead, with California second and Massachusetts third. For cemetery and monumental work, which calls for the finer grades of stone, Rhode Island stands first, the value of the output amounting to nearly $600,000 per annum, while Massachusetts is second and Vermont third, though it is generally said that the finest ornamental granite work is produced in Massachusetts and Vermont.

The beauty of the Barre granite, though recognized in the trade, did not warrant the development of quarries there on any large scale until, through a steady progress made by a few stone producers, Barre granite occupied so unique a position in the market that the demand for it became greater than the supply, and railroad accommodations soon followed. I visited the quarries seven or eight years ago, and was impressed with the fact that the deposit is one favarable for economical quarrying. The stone is sound at the surface and free beds are plentiful, but it was evident at that time that the accommoda-

tions for shipping were poor. Situated less favorably for reaching markets than the New England quarries it has been a surprise to many people that the Barre quarries should have developed so rapidly, and no better evidence of the popularity and beauty of the stone is needed than this growth.

An illustration is given at the head of this article, of one of the Barre quarries in the early stages of its development.

About three years ago this quarry came into possession of Messrs. C. E. Tayntor & Co., of New York. The illustration is of value in that it shows the appearance of things before the progressive hand of Mr. Tayntor took effect. The large stone in place is the site of the quarry at present. This stone measured 70x40x10 feet, and was such a large, sound and valuable franchise that Mr. Tayntor concluded to build a house over it. Illustrations are given of both exterior and interior views of this quarry.

The cover to this quarry is not a mere shed, but a substantially trussed roof with posts and side walls. The trusses are long enough to span the entire width of the quarry and are situated far enough apart to admit of the passage of the largest blocks of stone between them. Everything is detachable in sections so that a part of the roof may be opened at any place as though it were a door and a block of stone lifted through.

It is, of course, no new thing to cover stone about quarries in cold climates during the winter. The usual way is to put a temporary shed over the stone and by means of an ordinary stove heat it sufficiently to prevent damage by frost, but Mr. Tayntor has made a distinct departure in that he practically protects the whole quarry, making it comfortable and safe for work in weather of any kind. Steam pipes are laid around the walls of the quarry for the

EXTERIOR VIEW OF C. E. TAYNTOR & CO.'S COVERED QUARRY AT BARRE, VERMONT.

purpose of keeping the temperature above the freezing point and at a uniform figure. This steam can be taken from the exhaust of the quarry engine and is not an item of expense.

With snow covering the ground at a temperature of 20 degrees below zero in wintry Vermont, the men may work comfortably with their coats off in Mr. Tayntor's quarry.

When the question is asked whether or not it is best to cover a quarry the answer is naturally modified by reference to the nature of the stone, the climate and other conditions. In the case of the Barre granite quarry, Mr. Tayntor's experience has proved that it pays.

Most of the older marble quarries in Vermont are practically covered in that they are protected by being so far underground. One of them, the famous old Sheldon quarry, has for many years been covered by a shed roof, but I have been unable to find any record of any quarry having been heated by steam prior to Mr. Tayntor's experience.

Quarrying stone is hard work at best. The men are called upon to exert their powers of strength and endurance to a degree seldom experienced in manual work, and anything which adds to their comfort must result in more and better work. Every quarryman knows how expensive it is to lose time, and we seldom give full value to the real expensiveness of lost time. In granite the loss in stone due to frost may be still greater than in time. While the frost is in the granite the plugs and feathers cannot be depended upon to split in a true line, and many a handsome block has been spoiled. The heavy snows of winter not only retard the workmen in open quarries, but through the accumulation of snows and ice during the night much time is lost in the morning in uncovering the stone and getting the machinery in condition to work. Much might also be said in favor of Mr. Tayntor's quarry in extremely hot weather. It is very likely that he takes off the cover in summer, though the arrangement are such that a temporary protection from the hot sun might easily be given the men. Mr. Tayntor has erected a forge which enables him to do his blacksmith's work, sharpening drills, etc., within the quarry.

The large stone shown in the interior view was quarried for a monument. It measured 35 feet 6 inches by 3 feet 6 inches square, and weighed 35 tons. It was unfortunately broken in two while being hoisted out of the quarry by the breaking of a defective link in the hoisting chain.

The exterior views previously referred to show the ordinary forms of derricks used about quarries. These derricks have masts and booms of wood measuring from 50 to 75 feet, and are intended for lifting about 20 tons with a single line. Single line lifting is an important feature in dimension stone quarries, because of the readiness with which the lifting hook may be taken to any point in the quarry without being subject to the vexatious en-

INTERIOR VIEW OF COVERED QUARRY SHOWING MONOLITH.

tanglements of blocks and falls and the delays due to unreeving. These difficulties are increased by the use of wire rope to such an extent that it takes several men to render a rope of large diameter. Even with the single rope lift used in many quarries it is difficult to render quickly, and it is not an uncommon thing to see a heavy block of stone or a piece of cast iron hanging from a derrick boom and attached to the rope near the hook. The purpose of this is, of course, to assist in rendering, but when the hook reaches the floor of the quarry, all this useless weight is in the way and interferes with the pulling out of large blocks from points not directly under the derrick boom.

The first picture shows a large wooden mast which Mr. Tayntor erected for the purpose of lifting 20 tons with a single line. A heavy block hangs from the top of the mast at the left, and to the lower part of this block the hoisting rope is attached, passing under the mast and over the end of the boom. At the top of the mast is another block, and between the two blocks are many falls of rope, the end passing down to the hoisting engine. This system of rigging a derrick has been used for many years in some of the New England granite quarries. It serves a double purpose, in that it enables a quarryman to equip a common derrick for single line lifting and to use a small hoisting engine for lifting heavy loads. The two blocks are, of course, brought together during the process of lifting, and the height of the lift is measured by the height of the mast, except where the boom is also lifted. The lower block on the side of the mast through its great weight helps to unreeve. Such an arrangement as that described when

applied to a wooden derrick is a dangerous expedient. It cannot be sustained by any reasonable arguments when based on engineering construction. The strains are not properly proportioned to the resistance. It does not require an engineer to see how easily a bending strain may be applied to the mast when a heavy block of stone is being lifted with the point of pull situated at the top of the mast some distance from its center. The tendency is to buckle the mast. Mr. Tayntor broke a large mast at a point about ten feet from the top, and in order to prevent further breakages he put a truss and strut-rod on the side of the mast opposite the blocks. This is shown in the first picture.

THE LARGEST DERRICK IN THE WORLD.

Fifty-ton Steel Derrick at C. E. Tayntor & Co.'s Granite Quarry—99 Feet High, Containing One Mile of Rope.

But a stick of wood is too uncertain and perishable a thing for a derrick mast where such extraordinary strains are applied, and in the presence of which men risk their lives. In the heavy lifting—20 tons or more—the side block rigging should be prohibited by law. With the usual derrick rigging the strain is direct when the lifting rope passes over the end of the boom and under the mast to the hoisting engine, thus bringing most of the load on the derrick guys, and bearing centrally on the mast.

Shortly after a mast broke at Mr. Tayntor's quarry he called at my office and explained the situation. I advised an iron or steel mast as the only true remedy. Mr. Tayntor's strongly progressive nature and his conscientious care for the safety of his men, induced

him at once to take steps to provide a safe derrick of large capacity, and with the assistance of such able mechanical engineers as Milliken Brothers, of New York, he has placed at his quarry a steel derrick, the largest in the world. There is not a particle of wood anywhere about this derrick. The mast and boom are of the Phœnix construction, trussed to give them rigidity. Some of the sheaves are 52 inches in diameter. Mast 99 feet high and the boom has a radius of 71 feet. Over one mile of rope is used on this derrick, including iron guys and steel ropes of different sizes. The weight of the derrick complete is 50,000 pounds. The lifting rope passes from the load over the boom, around the sheave at the bottom of the mast, then to the heavy iron block, which is seen in the illustration at the side of the mast. Seven parts of rope connect this block with one at the top of the mast, the end of the rope passing down through the center of the mast to the hoisting engine. By means of a four-ton hoisting engine this rigging has lifted 37½ tons, at the rate of 3 feet 8 inches in 18½ seconds. Steam pressure 85 pounds.

Tests made by means of a dynamometer have shown that 300 pounds pull at the end of the boom will revolve the derrick when the boom is at right angles with the mast and the load 37½ tons. Messrs. Milliken Brothers have designed and are applying a turning apparatus for this derrick. The operation will be through an endless rope around a turntable and connected with a third drum to the hoisting engine. The rope will move at the rate of 200 feet per minute, thus revolving the derrick without load one complete turn in eight minutes. The operator by means of a lever will have complete control of the derrick.

The boom and the load may be lifted simultaneously, and the derrick revolved while the lifting is going on. By this means a stone may be taken from a point within ten feet from the mast, and placed at a distance equal to the length of the boom. The derrick has ten guys 1¼ inches in diameter each, and a steel hoisting rope 1½ inches in diameter. The boom fall rope being of steel ¾ of an inch in diameter.

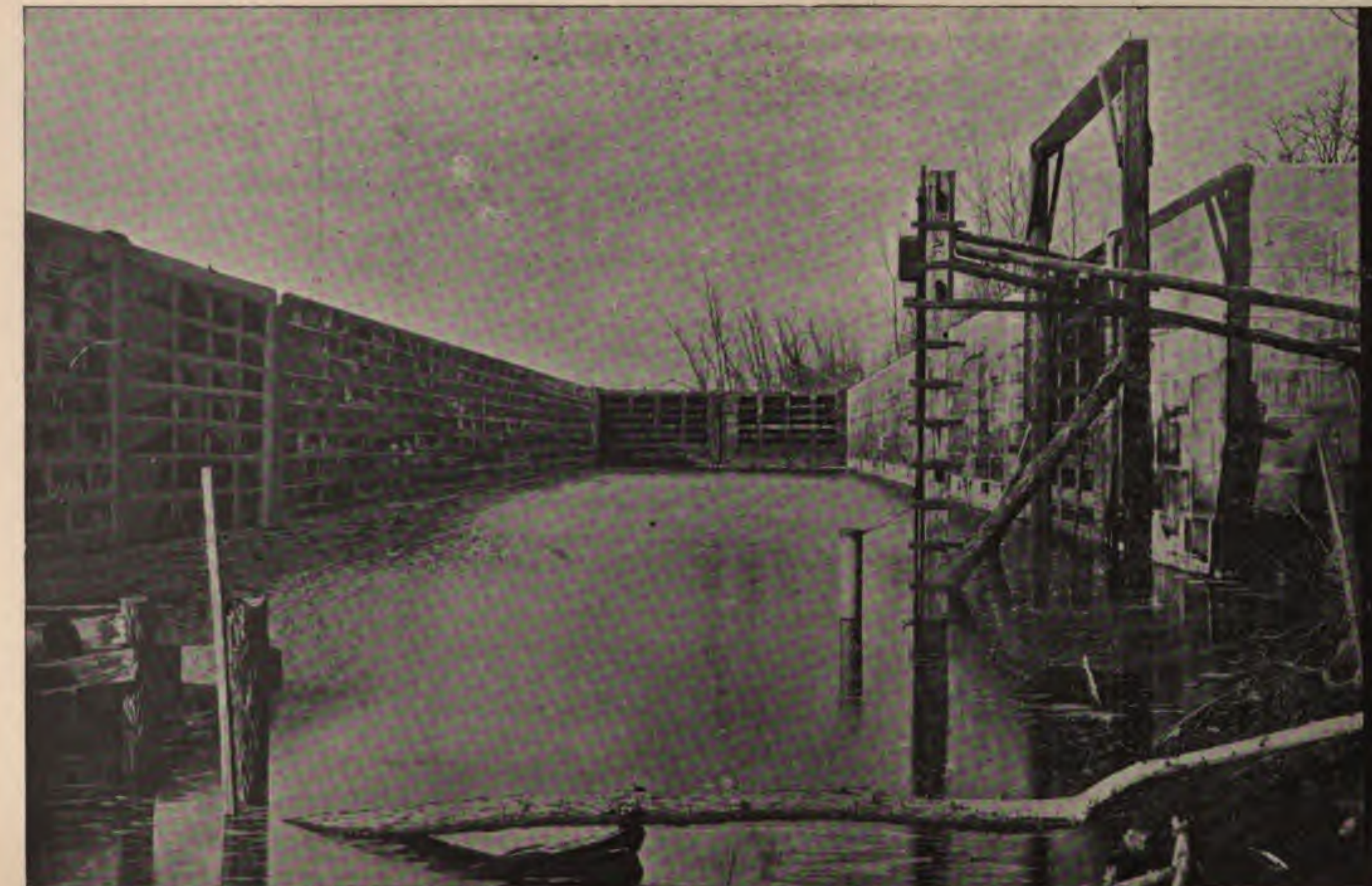
W. L. Saunders.

WEST ABUTMENT OF GOVERNMENT DAM AT MT. CARMEL, ILL.

CIVIL ENGINEERING ON THE WABASH.

FEW people, especially in the states east of the Mississippi, have any real conception of the importance of the improvement of the waterways, or rivers, that reach from the Gulf of Mexico to the British line and from Pennsylvania to Montana. What is known as the River and Harbor Bill, has been given a reputation, by an ill-informed newspaper press, that a large majority of the people have come to consider synonymous with corruption. But the sums granted by Congress have been meager indeed when measured by the importance of the question to the producers of the interior. The sums have also been wisely and economically spent, except, possibly, in the one thing that the meager appropriations have made the completion of engineering works so slow that the best economy was impossible.

Take the Wabash river. Its importance to Indiana and Illinois is only understood by the people of the towns along its banks, but a shallow rapids two and one-half miles from Mt. Carmel, Ill., known as Grand Rapids, just above where White river empties into it, prevents steamboats or barges from passing that point. In the year 1890, 40,000 tons of freight were carried on the Wabash between Terre Haute and Vincennes, and this alone shows the importance of the river, and what it would become were it rendered navigable to the Ohio. For several years the government has been constructing a lock and dam at these rapids, and the lock and dam abutments are now completed. The illustrations show the massive nature and



CIVIL ENGINEERING ON THE WABASH.—INTERIOR VIEW OF NEW LOCKS.

CIVIL ENGINEERING ON THE WABASH—RIVER WALL OF NEW LOCKS.

completeness of the masonry and engineering work, and that when the work is finished it will stand for centuries. The work is an example of the thoroughness with which the national government forwards its undertakings.

The lock is on the Indiana side of the river, and is constructed of large sawed blocks of oolitic stone, put together with the most scientific masonry, as the illustrations will show. It is 52 feet wide, and 325 feet long. The lift of the dam will be 11½ feet, which will give slack-water navigation for a distance of 11½ miles, thus permanently improving a portion of the river which has been impassable except at high stages of water. The height of the walls is 27 feet from the sills, 14 feet wide at the base and inclining upwards to seven feet on the top. This refers to the walls proper. At the head and tail bays are buttresses for holding the gates, that are 16 feet wide, for their entire height, which is equal to the balance of the wall. The gates are of the most substantial construction and are moved by capstans. The abutments for the dam are shown by the head bay, above the lock, and by an illustration of the construction on the Illinois side of the river. Both constructions consumed 8,250 cubic yards of stone. The front face of the abutments are 50 feet, with wings 35 feet. The walls of this part are 20 feet high, ten feet wide on the base and seven on the top. Up to high-water line the masonry of the abutments is smooth finished, above it is rock-faced. The distance between the abutments is 1,100 feet.

O. L. PETITDIDIER.

In sinking the foundation for the Illinois abutment a drift of granite, porphyry and limestone bowlders was struck about eight feet below the river bed. The bedrock upon which this rested was a carboniferous sandstone, which was scored by glacial action.

The work is under the general control of Col. Garrett J. Lydecker, of the U. S. Engineer Corps, who has charge of the Louisville district, which includes the Wabash and White rivers. His assistant, who has practically superintended and built the works near Mt. Carmel, is Mr. O. L. Petitdidier, an engineer whose career and history would make a romance. He is a Frenchman, educated in the engineer service of the French army, and was an assistant on the corps of *ponts et chaussées*. During his career he was stationed at various points in North Africa. After the Franco-Prussian war, or in 1872, he came to America and worked in private engineering for two years in Cincinnati, when he engaged in our government service under Col. W. E. Merrill, and since under various officers, has been connected with

works included in river and harbor improvements, of which the lock and dam near Mt. Carmel he is still engaged with. He is thorough in his profession, as these works testify, and his portrait here shown, does him only fair justice.

REALISM IN IDEALS.

A MONUMENT around which clings a remarkable romance stands in South Laurel Hill Cemetery, Philadelphia. It is of marble and represents a lady with a twin upon each arm. The monument is erected over the grave of the wife of a Polander named Sanders, who once dwelt in Philadelphia and earned his bread as a wood-carver, at which work he was a master. His wife passed away in child-birth, and the heartbroken widower spent many a long night in the wearying but loving labor of cutting out her life-size image as it now stands gracefully upon the pedestal, whereon he engraved the figure of his mallet and tools, when the last line was finished. He lies not there himself sleeping peacefully beside his wife, as was his wish, overlooking the Schuylkill. He wandered back to his native Poland, sacrificed his life on a hard-fought battlefield, and there his ashes lie, mingled with those of his sires.

The above, from the *Monumental News*, recalls a piece nearly similar that a quarter of a century ago was in the cemetery of Rose Hill, near Chicago. The sculpture—of mother and infant—had been executed in Italy (we have forgotten the author), but its pathos bespoke the highest order of artistic conception and execution. Yet, for monumental purposes, such intense realism is unpleasant. A typical exponent of the same sentiments were better expressed by forms, or types, that impress all humanity, rather than by realisms drawn from the experience of the individual, because humanity does not express its sentiments through an individual, but from the collective source of all. It is akin to Grecian expression of female beauty. No such face as the Minerva of Phidias, or the Aphrodite of Praxiteles ever was seen. But as types of the collective sense of female beauty they have never been surpassed, and because they expressed ideals, and not reals.

CIVIL ENGINEERING ON THE WABASH—VIEW OF NEW LOCKS LOOKING NORTH.

GRANITE STRIKES AND LOCKOUTS.

NEVER before was there such a paralysis of the granite industry in New England. There have been more or less serious disturbances of a local character, largely, though some have extended to the larger center of the industry, but never since the granite industry became one of the leading pursuits of New England has there been such a complete cessation of work in all departments. Outside of a very few small firms, and some who have conceded the demands of the men there is hardly a hammer lifted in New England to-day.

A carefully prepared list of firms and places indicates in some degree what a general stoppage of business in some towns it is for the granite workmen to be idle, whether they be quarrymen, paving-cutters, cutters or employed in any other capacity about the quarries and yards. Following is the table as near as the writer has been able to gather the statistics:

Hallowell, Me., (Hallowell Granite Co.)	1,000
Vinal Haven, Me	1,000
Clark's Island, Me	500
Long Cove, Me., (Booth Bros.)	500
Hurricane Island, Me., (Booth Bros.)	500
Tennant's Harbor, Me	500
Green's Island, Me	500
Mt. Desert, Me	1,000
West Sullivan, Franklin and Bar Harbor, Me	1,000
Friendship, Me	500
Mt. Waldo, Me., (John Pierce)	400
Round Point, Me., (Brown & McAllister)	200
South Thomaston, Me	150
Concord, N. H., (J. E. Batterson & Co)	2,000
Marlboro, N. H	750
Redstone, N. H	750
Fitzwilliam, N. H	500
Milford, N. H	200
Nassau, N. H	300
Suncook, N. H	300
Barre, Vt	5,000
Montpelier, Vt	400
West Dummerston, Vt	400
Ryegate, Vt	300
Brattleboro, Vt	200
Williamstown, Vt	300
Westerly, R. I., (quarries of J. G. Batterson & Co., Senator Dixon, Smith Granite Company and others.)	2,000
Nyantic, R. I	200
Quincy, Mass	10,000
Worcester, Salem and New Bedford, Mass.	200
Monson, Mass	2,000
West Chelmsford, Mass	200
Bayview, Mass	500
Lanesville, Mass	2,000
Rockford, Mass	2,000

Pigeon Cove, Mass.	600
Haverhill, Mass.	1,000
Millstone Point, Conn.	350
New London, Conn.	200
Stony Creek, Conn. Norcross Bros. and others	1,000
New Haven, Conn.	200
Total quarrymen, paving-cutters, granite-cutters and blacksmiths,	41,600
Laborers,	5,000
Polishers	2,000
Carpenters and boxers	2,000
Truckmen and drivers,	500
Engineers and derrick men,	500
Total	10,000
Grand total of idle workmen in the quarry region,	51,600

The prime cause of the idleness was a misunderstanding over the renewal of the bill of prices which ran out May 1, 1892. The men want the bill renewed to terminate May 1, 1893, and the employers want the bill to terminate January 31, 1892 and all succeeding years, and would prefer to have it run longer than one year, as such a condition of affairs would give them a greater feeling of security and they would not have to hesitate so long over large contracts. The pay in most cases was satisfactory. The wages were all that the men asked and some manufacturers voluntarily advanced wages, but that made no difference. When the time came for the renewal of the bill the men absolutely refused to listen to any proposition which suggested a bill to terminate December 31.

Though there was much misunderstanding there was no open war until after the meeting of the New England Manufacturers' Association in Boston the week preceding May 14. It was there voted that if the men did not sign the bill as the manufacturers wished, that the shops should be closed Saturday, May 14, indefinitely, or until the men signed the bill to terminate December 31 of this and all succeeding years. So far the fight has been waged with unabating zeal. Neither side shows any disposition to yield as a whole. A few individual proprietors have conceded the men's demands and signed the bill terminating in May. And thus the matter stands.

Meanwhile the 50,000 men are idle, business is seriously stagnated and various troubles of a financial nature are arising from the fight.

The manufacturers are determined to fight it out to the bitter end and the men are equally determined, so there seems to be no way out of the difficulty. Suggestions of arbitration have been made, but both manufacturers and men object saying that it would be of no use to any of them and only serve to complicate matters. A few manufacturers have gone to work. Some have withdrawn from the association and re-opened their quarries, and still others say that they will do so later, if a settlement is not reached soon.

In some localities the men have re-opened old quarries and have gone to work and are gettlng big prices for their granite. In other places coöperative work is going on and in still others manufacturers have begun on the profit-sharing basis. But the great majority are idle and thousands of dollars are being wasted each day by the idleness of the men. In many instances the manufacturers cannot afford to lose the business as well as the men can.

It would seem to those on the outside that it is a comparatively unimportant affair and one that might have been settled or compromised without all this loss or waste of time and money. Yet the men say that it is an important matter to them. They say that if the bill terminates in mid-winter they will be at the mercy of employers who will have them completely in their power and that they will have no means of withstanding a lockout, or reduction of wages.

The manufacturers say that if the bill terminates in the spring they cannot safely figure on large contracts because they never know whether the old bill is going to be renewed or whether the men are going to strike for higher pay. As a case in point they instance their present predicament, when, having made long-term contracts for large work they find themselves confronted with a complete paralysis of the entire granite industry all over New England.

Whichever way the trouble is settled it is most likely decisive and will probably put at rest all difficulties which may arise in the future. All business men whether stone dealers or engaged in other business will fervently hope so. For it is ruinous to all kinds of business to have such an entire prostration of any industry as there is in and about the quarries of Barre, Vt., and Quincy, Mass. It will take months for the towns thus afflicted to recover from the effects of the financial stress under which they are now laboring. It has taken months and years to build up the industries, and now they are seriously crippled by this trouble which seems to show no signs of abating or getting nearer a settlement than it was in the beginning.

Burton H. Allbee.

BUILDING STONES OF THE NORTHWEST.

THE building stones of the Northwest furnish a basis for many important industries. They are yearly becoming of more importance as the cheap structures which characterize the first settlement of all countries are being replaced by permanent edifices; as public buildings of a substantial character are being erected by states and counties and by the Federal Government, and as the increase of wealth leads private citizens to put up handsome homes. Our quarries are destined to constantly increase in their money-earning power and their capacity for the steady employment of skilled labor. Their value should be more widely appreciated and the area of distribution of their products should be widened by systematic effort. Up to this time the market for the building stones of Minnesota and Northern Wisconsin has been limited to these states and to the prairie states further West. From the great market of Chicago our quarrymen are practically shut out by unjust discriminations in railway tariffs made in favor of the New England quarries. To remedy this manifest unfairness, which puts Maine granite down in Chicago for a less rate than is charged for a haul of one-third the distance from St. Cloud, the intelligent coöperation of our quarrymen is needed. A strong organization should be effected and a competent executive committee appointed to persist in an effort for fair rates until the roads are brought to terms. No injustice can long resist exposure and vigorous opposition. It is no doubt for the interest of the Eastern trunk roads to keep the Northwestern stone out of Chicago, but it is just as much for the interest of our home roads running from our quarries to that city to haul our excellent building material to that market; and if they should make a fight for the right to do so at rates corresponding with the length of their haul compared with that from the distant quarries of New England they would succeed. The result would be to give them an enormous tonnage and to double or treble the magnitude of the stone industry in this region. For durability, for variety of texture and color and for economy in quarrying our stone is unsurpassed anywhere in the world. We have granite that takes a higher polish than the famous Aberdeen granite of Scotland and is found in more beautiful tints; we have jasper of the finest quality; we have a wide range of sandstones, including a dark-red stone handsomer than that obtained in New England, and we have excellent limestone. Many of our quarries lie convenient to both water and rail transportation; all of them are reached by important railway systems.

Let us look first at the limestone, which, from its abundance along the

bluffs of the Mississippi, and the fact that it is excavated from foundations in the business district of St. Paul, came first into use in that city for business blocks and churches. This stone is somewhat discredited of late because of its softness and the fact that it is scaly and absorbs moisture. There is a difference in the quality of St. Paul limestone from different quarries.

The hardest of our limestone is that known as Kasota stone or Mankato stone, from the two points, twelve miles apart on the Minnesota River, where it is quarried. It has a pinkish color when first cut. It discolors in the smoky atmosphere of the city, but it is in all respects an excellent, durable stone. About 500 men are employed in the quarries of Mankato and Kasota, which are the most extensive in Minnesota. The stone finds its chief market in Iowa, Nebraska, Kansas and Missouri.

At Dressbach, on the Mississippi, a light-colored sandstone is quarried. It is not popular by reason of its rapid discoloration under the influence of the weather. Its merit is the great ease with which it can be worked. The sandstone of Kettle River, Minnesota, is of a very different quality, being so hard that it might almost be called a crystallized stone. These quarries are increasing their output and assuming an important rank. This stone has been extensively used in Minneapolis for street curbings.

The brown stones of the north shore of Lake Superior are of high quality and of durable color. These are pure sandstone, of a ruddy color and have great crushing strength. The principal quarry is at Iron River, twenty-eight miles from Duluth.

The Bayfield sandstone has a dark-red color and an excellent texture and has so high a reputation that it is shipped to the East and the South. It is taken out of a number of quarries on the shore of Lake Superior, near Bayfield, and Ashland, Wisconsin. It is as easily carved as marble and hardens by exposure. resembling in this respect the cream-colored sandstone used in Paris. The Portage Entry stone of the northern peninsula of Michigan, resembles closely that of Bayfield and competes with it at Eastern points. The Fond du Lac stone, quarried near Duluth, is of a somewhat lighter color, owing to a different stain of oxides, and is a strong favorite in the Twin Cities as well as in Duluth and Superior. Its texture is a little closer than that of the Bayfield stone and it is consequently a little harder to work.

At Luverne, in the extreme southwestern part of Minnesota, is quarried a crystallized sandstone of blood color, a little somber but very novel and striking in effect.

At North Sioux Falls, Minnesota, there is a sillicified stone of strawberry color, commonly called jasper, but not a true jasper, which is exceedingly handsome and is destined to become popular. Among the useful stones

may also be mentioned that of Frontenac, Minnesota, on the Mississippi, which is cheaply quarried and is used locally.

We now come to the granites, which are the special pride of Minnesota. The most extensive ledges of gray and red granite found anywhere in the United States in a position for successful quarrying are unquestionably those in Stearns and Benton counties, near the towns of St. Cloud and Sauk Rapids. The first work done on those ledges was done about eighteen years ago by Matt Breen, of St. Paul. The industry has steadily grown but is hampered, as we have said before, by unfair freight rates, and it received a blow a few years ago from a source which should have been its friend. The State established a reformatory at East. St. Cloud, which is in fact a penitentiary for convicts sentenced for short terms, and these men are kept at work cutting stone. This circumstance would not necessarily have been detrimental to the stone industry had not the management of the institution cut the prices in order to at once command a market. Having nothing to pay for the prison labor except the cost of feeding and guarding the men the management of the reformatory could make a figure on curb stone and paving stone, which are the chief reliance of granite quarries, far below what the firms in the quarry business must charge. The result was that capitalists contemplating important improvements abandoned their plans and a number of quarries were closed. There should be statutory restrictions placed on these prison quarries so that it should be unlawful to place their products on the market at rates destructive of free competition. Fewer men are now at work in the quarries of Stearns and Benton than there were three years ago when the St. Cloud Reformatory was established. The State had no moral right to deal this blow at a great and promising industry.

Mention should be made here of the Ortonville granite, which comes from the western border of Minnesota. It is not specially inviting in color, but it lies in an enormous stratum from which monster pieces are taken out. The new Hennepin County court house in Minneapolis is built of this material.

We now come to the jasper, a pink stone of a hardness equal to granite and of a finer texture. At the town of Jasper, in Pipestone County, on the Great Northern road, are found the most important ledges of this stone. Solid pieces twenty-five feet long have been taken out.

On the north shore of Lake Superior, about thirty miles east of Port Arthur, a very handsome variegated stone is quarried, which is called jasper, and is well suited for panels, mantels, table-tops and other uses which employ ornamental marbles.

The Lake Superior region, long famous for its mineral riches, and just now enjoying a new distinction through the quite marvelous iron ore discoveries near Duluth on the Mesaba Range—known to the Indians as the

"Big Man's Hills," seem destined to be famed as far and wide for other and perhaps more precious deposits.

Gold, silver and copper have been found, oftimes in abundant quantities, while coal deposits are believed to be awaiting the fortunate explorer and enterprising capitalist, without whom the secret stores of nature are of as little use as the flowers that felicitate the desert air.

But though it would seem a fairy tale to assert still further claims for this realm of the inland waters, yet the recent discovery of colored marble in the beautiful Algoma district on the Canadian north shore of Lake Superior impels the truthful chronicler to do so. Explorations made last September resulted in this rich find thirty miles east of Port Arthur on the Canadian Pacific railway and almost within hearing of the breakers on the lake. The formation appears on the surface, projecting somewhat above its surroundings, and covers an area of sixty acres. Blocks of the marble were cut out and sawed into slabs which have been sent to Chicago and other eastern points for examination.

The marble is a most beautiful variegated kind, especially adapted for interior furnishings and more rare and precious than any similar formation in the United States. It would take the place of the African and Italian colored marble for mantels, table-tops, panels, and the myriad things of convenience and beauty that give an exquisite charm to the modern home. It takes a dry polish as distinguished from the acid finish of its foreign competitors, and is unaffected by time or the elements. The reflection from the polished surface is almost that of a mirror, and as the deposit is free from cracks and blemishes, a block or slab of any desired dimensions can be secured. The same block sawed into a number of slabs presents as many different and unique surfaces, for no two are more alike than two window panes under the magic and beauteous touch of Jack Frost. One presents the appearance of mosses, another of autumn leaves, others of grasses, cones, and the innumerable growths and debris of primeval forests, as if the soul of inanimate nature had found a heaven in the hidden deposits of this Northland.

The ephemeral creations of thousands of years ago are thus preserved in all the beauty of their original luster and outline, and there is presented to the interested observer the petrified remains of vegetation kissed into being by the sunshine before man had known the earth and while perhaps the stars were singing their matin song.

How wondrous, indeed, are the riches of this realm in which Neptune and the Snow King contend for supremacy! In a region barren and desolate to the pioneer, forbidden even to those who could see for it a commercial future, nature has been lavish of her bounties and man has transformed them into present blessings. Not content with a variety of beautiful woods,

with iron and many other metals, marble has been added in abundant quantities and of unrivaled excellence. With the growing affluence of the American people this new discovery promises to come into great demand, and the owner of a marble quarry will have a more precious possession than he who holds in fee mines of silver or gold.

The convenience of this deposit to deep water and to railway transportation, vastly enhances its value in the ground and opens to it all the markets of the East. Lake Superior is thus rapidly becoming not only the head of navigation but the great center of many industries; and though she may be an "unsalted sea," the riches of her shores are "the salt of the earth."—*The Northwestern Magazine.*

I KNOW an artist well to do
  Whose woe beclouds his play-time;
His worriment relates unto
  The winter-time and May-time.

When winter raves with gust and blow
  He waxes glum and glummer,
And says in pain, "Where shall I go
  To sketch and paint next summer?"

And when he skips 'neath deep green boughs
  As happy as a sprinter,
His bugbear is the boarding-house
  He's got to find next winter.

R. K. Munkittrick.

BELLE was my playmate—sweet Belle! Sweet little Belle; and how I loved her no tongue can tell! You needn't laugh, 'tis true, and every trick that I could do, why, Belle could do as well.

She drove the cows home from the wood, and on old "Brindle's" back she stood, and swung her hood, and danced her jigs, and sometimes drove her by her long thin tail, and clubbed the pigs that snuffed about the tin milk-pail.

And she could drive the balky mare, that sometimes wouldn't go, or pull a garden hoe; or else she backed and knocked about, and kicked the dash-board out; but mean as was that mare, Belle didn't swear.

She sometimes climbed up in the new hay-mow, and made her bow, and said, "Watch, now," and then she turned her somersets; and when she climbed the hickory trees, she skinned her knees, and tore her pantalettes.

There wa'n't a single country girl, that strolled the river banks, that could begin to equal Belle in playing funny pranks. If I should tell half Belle could do, I'd not get through till noon, so all I'll tell, just now, is how, that we did catch a coon.

'Twas in the balmy month of May, when everything looked bright and gay, and Belle from home had run away, to have a play with me. Said she, "What shall we do to-day?" Said I, "A-fishing let us go." Said she, "All right, you get the hoe, and dig the worms." And so I did. And Belle, she got the hooks and lines; then away we went, through nooks and vines; and "Maje," he trotted by our side, and scratched his hide, and wagged his tail, and snuffed the holes for mice and moles, and scared the setting quail.

And when we reached the "fishing-hole," just by the "old flood trash," why,

"Maje," he made an awful dash, and barked, and pawed the brush about; then pretty soon out popped a coon, not more'n a rod from Belle and me, and scampered up a basswood tree.

"Let's catch the coon!" said Belle. "We will," said I, "and sell his hide, and go to Barnum's show." "No; that will do," said she, and gazed up into the tree.

That basswood tree was very high, its branches seemed to reach the sky; it leaned right over the "swimmin'-hole," the deepest place that could be found—just where old Deacon Dudley's soul popped up to heaven when

"SHE SOMETIMES CLIMBED UP IN THE NEW HAY-MOW."

he got drowned—and right up on the topmost limb, the coon had clim'—that limb that leaned half o'er the stream, and there he grinning sat, and watched us like a cat; and twitched his ears a-harkin', loud, at "Maje," the dog, who danced upon a log, and beat hisself a-barkin'.

Then Belle spoke sly, "Let's climb the tree, and punch the old coon off." "All right," said I, "he's mighty high, but then we'll try."

I got a pole and climbed the tree, and Belle, she folowed after me. And when we reached the topmost limb, we looked to see how high we'd clim'. It was a very great ways up—a hundred feet, or higher, for "Maje" looked like a little pup—his eyes like sparks of fire.

That limb looked sort 'o brashy like, as basswood trees all be, and I scanned it carefully—it didn't seem quite safe to me, but Belle, you see, kept nagging me, as though I was a loon. "Go on," said she, "go out and punch the coon!"

"Now, Belle," said I, "we're awful high——" "Go on," said she, "this limb is stout; go out and punch the coon, or let me by, and see if I can't punch him off."

Now, Belle had climbed full many a hickory tree, whose limbs are tough and limber, but she didn't know as much as me about the brashy timber. The limb, 'tis true, was inches through, but what of that—please mind me; out on the end a fat coon sat, and a big girl just behind me. Besides, I thought I saw a flaw, and a weakness at a knot.

But Belle, she got impatient, and she crawled right over me; and I felt most awful skarish like, way up there in the tree. "Give me the pole," said she, "the limb won't break, you spooney—just see me punch the cooney."

She punched the coon with all her might, and when she struck him on the head, his eyes turned red, and he grabbed the pole and showed her fight. "Get out, you ring-tailed beast," she cried, as the coon came creeping near her side, with teeth a-grin, and eyes a-glare, prepared to fight death's battle there. "Go 'way, you ugly thing!" yelled she, yet still the coon did nearer creep, and soon he made one vicious leap, and planted deep, his claws in Belle's bare throat; and then to rid herself from him, she fell with force upon the limb, when it did break, and Belle, and coon, and limb, and I, did earthward fly—and what a splash we all did make, as we came tumbling from the sky.

How long beneath the water we did stay, I could not say—it seemed about a half a day. When we came up I was quite out of breath, and Belle had me around the neck, just hugging me to death; and she spurted water from her mouth and nose, like a three-forked hose; and I tried to stop her choking me, but she wouldn't, and gouged her nails in my neck when

"I CLIMBED THE TREE,
AND BELLE, SHE FOLLOWED AFTER ME."

she shouldn't, and she tried to squeal, but she couldn't; but pretty soon, her face beamed with a smile, for she came to herself in a little while, and she felt just as happy as a maid from the moon, when she saw "Maje" just shaking and ducking that coon.

Now, Belle and I, hand clasped in hand, swam to the land, and "Maje," he brought the dead coon to the shore, and we skinned him and stretched his hide on the barn-door, and then we sold it and got money enough to go, to Phineas Barnum's Great Big Show.

J. Murray Case.

BUILDING STONES, THEIR STRUCTURE AND ORIGIN.*

TALCOSE STONES.—Talc is the name of a mineral consisting of a silicate of magnesia, and is represented by various forms as steatite, French chalk, asbestos, jade, etc., but the building stones formed of silicate of magnesia are the serpentines. Being essentially magnesian, the beautiful stone called serpentine is of an entirely different character from sandstones, limestones and slate rocks, since they, with the exception of dolomite, are devoid of magnesia, and in dolomite it is present as the carbonate not the silicate. Although the resemblance between serpentine when polished and some polished marbles is very great, yet it will be seen they are essentially different stones, marble being a carbonate of lime and serpentine a silicate of magnesia. Serpentine is a metamorphic rock, but unlike, again, marble and slate, it is an altered igneous rock. Much has been written on the production of serpentine, but it may be concluded that the great intrusive masses of the rock, such as that at the Lizard in Cornwall, have been produced by the alteration of igneous rocks that have been rich in olivine, which contains about 84 per cent. of silicate of magnesia. Such a rock is the lherzolite of the Pyrenees, an ultra-basic rock, and of the very high specific gravity of 3·35. This rock seems to fulfill the conditions necessary for the production of serpentine by the action of permeating water. M. Daubrée, by fusing serpentine with the addition of magnesia, obtained a product possessing the characters of olivine. Serpentine is a compact rock, with the smooth surface characteristic of the magnesian rocks, and a dull or very faint luster, of various prevailing colors, usually green or red, and streaked or veined with steatite and other minerals.

The chief locality in the British Islands for serpentine is the Lizard district of Cornwall, where it has all the appearance of an intrusive mass, but is traversed by dykes of gabbro or diallage-rock. But serpentine also occurs in Anglesea, Galway and other places in Ireland, Banffshire and other places in Scotland and the Shetland Islands. It has been contended that some serpentines may have been derived from dolomites by metamorphic action, and the serpentinous ophicalcites of the Laurentian rocks of Canada are doubtless altered sedimentary rocks.

FELSPATHIC STONES.—A very numerous, varied and important group of

*From a paper read by Prof. J. Logan Lobley, F. G. S., at the meeting of the Society of Architects London.

building stones may be formed under this heading, for felspar is the prevailing mineral of the granites in their great variety, the syenites, the porphyries and of the acidic volcanic rocks. Ordinary felspar is a silicate of alumina and potash, and a variety of great importance, called labradorite, is a silicate of alumina and lime. It is the former, usually called orthoclase, that is the mineral constituting this group of stones. The most important of these as building stones are those comprised under the name granite. The granite rocks are very various, but all granites must contain felspar and quartz. To these may be added mica, hornblende, talc and other minerals, but ordinary typical granite consists of felspar, quartz and mica. Granites are therefore very different in character from all the stones previously mentioned, which each consist mainly of but one mineral. The minerals forming granite are likewise, although intermingled and closely packed, yet separate and distinct, and clearly separately displayed to the eye. Since felspar is sometimes gray and sometimes pink and sometimes rich rose color, and the prevailing tint being mainly due to the color of the felspar, granites vary in color accordingly.

That granite has been produced by the crystallization of its component minerals from matter in a fluid or fused state there can be no doubt, and it is possible to ascertain the order of the separation and solidification of the minerals. It is found that the grains of felspar and mica are partly imbedded in the quartz grains, and hence it is concluded that the quartz was the last to solidify. It was also found by Sorby and Zirkel that the quartz grains contained minute cells partly filled with water.

The size of the grains varies very much, some granites being very fine, some very coarse, while many are of medium texture. In the well known grey Aberdeen granite and the pink Peterhead granite we have perhaps the most typical granites, since they are moderately fine-grained, and regularly intermingled felspar, quartz and mica granites. In some granites distinct crystals of felspar are conspicuously seen; these are called porphyritic granites, some of which are highly ornamental, as in the beautiful rose-colored Shap granite, seen in the chain-posts in front of St. Paul's, in which there are large crystals of rich colored felspar. The luxullianite that was used for the Wellington sarcophagus in the crypt of St. Paul's is another beautiful example of a porphyritic granite, and the stones of the London bridge display crystals of felspar of extraordinary size, and afford an excellent illustration of an English grey porphyritic granite.

The exceedingly tough mineral, hornblende, is a constituent of many granites, which form, from their great durability, excellent road material. But hornblendic granite has been put to a much more interesting if not so practical a use, by being employed by the ancient Egyptians for those great monoliths, obelisks and colossal statues, that after three thousand years com-

mand the admiration of the world. This granite was quarried in Upper Egypt at no long distance from the seat of government at the time, and the places where these fine works were first erected. It was in later times that they were brought to a great distance from their quarries and re-erected in Lower Egypt. Lower Egypt has in its turn given them up to adorn the public places of Rome and Venice and Paris, and lastly London and New York. As the place where this granite was worked was called Syene, the name syenite was given to the Egyptian horneblendic granites. The petrologists have, however, now decided to restrict the term "syenite" to a rock consisting of felspar and hornblende, which, not containing quartz, would not be a granite. Thus the Egyptian granite, although from Syene, is not syenite but hornblendic granite. It has been disputed whether there is grey granite in Egypt. The two famous columns of the Piazza San Marco, Venice, one red and the other grey, are both reputed to be Egyptian, though brought to Venice from Tyre in 1127 by the Doge Michielli. The column on which stands the group of St. Theodore and the Crocodile is doubtless of the red granite of Egypt, but that surmounted by the Lion of St. Mark, of grey granite, if it be Egyptian, is the only great monolith known of Egyptian granite not red, although there are some small works of grey granite reported to be of the granite of Egypt.

IMITATIVE FORMS IN ROCKS.

THERE is a universal tendency to seek and sometimes to see in the forms of objects around us representations of the human figure or of animals and plants, says M. Stanislas Meunier in *Popular Science Monthly* for May. Many interesting examples have been recorded and pictured in *La Nature* of rocks and mountains presenting resemblances to animated forms. We are quite ready to discern in the clouds all sort of personages; and at periods when superstition has been active, apparitions have been described, the whole existence of which consisted of misinterpreted simple resemblances. Stones have usually been considered especially worthy of attention in this category; in tubercles of sandstone and nodules of flint it is easy to find features analogous with the most various objects. A block of sandstone is exhibited in the forest of Fontainebleau on which one willing to see it may recognize a petrified knight on his horse, all of the natural size. A nodule of sandstone was once brought to me in the geological laboratory of the museum, on which the owner saw the portrait of our Lord on the cross. Some persons are specially ingenious in finding resemblances in flints; and Boucher de Perthes admitted into his Atlas of Celtic and Antediluvian Antiquities a whole series of figures of imitative forms of that mineral.

E—*Stone.*

FLAGELLATION.

TILL wheat, or corn, from out its husk is shed,
And has a threshing, we can get no bread,
The chaff, too, must be winnowed by the fan,
Before the grain is fit for use by man.
Not only so, but in the mill be ground,
Ere the pure whiteness of the flour is found,
And yet, the "leaven" must its mission do,
Search every part, with its life-giving brew
Then must the furnace-heated oven bake,
Before a perfect "staff of life" we make.

So Christians, if they wish a perfect mind,
Must first be thrashed, then be from chaff refined;
Self must be powdered, like the calf of gold,
Then can the "leaven" of the gospel hold,
And permeate each thought, word and act,
Ere 'growth in grace,' is an accomplished fact.
Still in the furnace we must go, I fear,
Before the figure "of the fourth" appear,
Few of us, the great value know as yet,
By threshing, grinding, roasting, we may get.

M. D. Stoutheart.

ANOTHER EXPLOSION.

"THAT thunder-storm went off to the north exactly as I predicted it would;" said Mr. Norris, with dignity.

And then, as a stunning peal of thunder followed a flash of lightning that tore the chicken-house to slivers, little Robby remarked, innocently; "Yes, and it 'went off' again, then; didn't it, papa.?"

Harry Romaine.

IS THERE AN AMERICAN ARCHITECTURE?

MUCH has been written and said in reference to an American style of architecture. As a style, we have not as yet reached the ideal, yet we have not only been tending toward it, but have in a certain way realized, if not the ideal, yet that intensive form of it that leads to an ultimate conclusion that American individuality is asserting itself, in its own way, to realize a purely American ideal.

It is useless to argue that the American ideal, if realized, must result in a composite style. This is true of every style, and has been true of all styles. The Roman and Grecian styles were as much formed out of antecedent methods as our own, with the exception that the ancients had a less prolific resource to draw upon and a less exacting system of life to conform to than we moderns, who may draw upon a longer reach of the past, and may even cover the classic grounds, that in the days of Augustus, were even then thought to be overworked and trite.

Yet they were neither overdrawn upon nor tritely wrought. They had developed, exactly as we are now developed, out of the customs of the time, and the necessities of life. The pine tree of the Gothic forests changed the round Roman arch into a stone replica of itself, and if we were to search for parallels, we need only to compare the cathedral of Milan to a huge mountain, and its multitude of spires to the pine trees that cling to the mountain sides.

But an American style can be nothing of this. It demands ideals, the same as Greek or Roman or Frank demanded them. But fortunately, we think not the same ideas. Nineteenth century utilitarianism has ideals of its own, and the American of all peoples, is the most utilitarian, and still permeated with artistic instinct. Mr. Norman S. Patton recently read a paper on the subject before the Chicago Architectural Sketch Club, that technically as well as generally and with artistic instinct touches this point, that we are sure will be appreciated by architects and artists alike. He says:

"There may be some who think that as inventive a people as the American ought to start an entirely new and unique style of building, and there are architects who have considered themselves as apostles of such a new movement. Their success has not been encouraging, and I hardly need to argue before this club that whatever style we adopt, it will be based on some other that has gone before. The world is too old for any radical new forms to be

evolved, unless we employ new materials which require some characteristic treatment. Our Chicago system of a steel skeleton inclosed in a casing of masonry may require a modification of preconceived methods of architectural treatment, but as long as we have to consider masonry, whether of brick or stone, we will find that lintels, columns, piers, buttresses and arches, round, pointed, elliptical, segmental and flat, have all been tried by former generations, and do what we will we cannot avoid following in the footsteps of some of our predecessors. We have already had in this country revivals of all the principal styles of architecture, and I propose to examine whether any of them give sufficient promise to be adopted as an inspiration for or a foundation of an American style. Shall we follow the Egyptian, Greek, Roman, Romanesque or Gothic, or any modification of them?

"We must not expect that we shall ever have one style to which all architects shall give adherence and to which they shall confine themselves for buildings of all classes. Our country is so vast, and includes climates both cold and hot, moist and dry, and the requirements of modern buildings are so varied that no one 'style' of design can adequately cover the whole field. We cannot conceive of a frame dwelling and a brick warehouse being built in the same style unless we give to the word a very broad significance. We may, however, suppose that at any one time the majority of architects of this land will be working in the same general spirit, and that their work will show such similarity of treatment as to constitute a distinct style of architecture. This style will not remain stationary, but will have a constant growth and change. My purpose in addressing you on this subject is not to enter into abstruse speculations upon the architecture of the future, but rather to discuss what we ought to make our architecture now. If there is to be a national style in which we are to have a part, what shall that style be?

"What style, if any, is adapted to the greatest number of our American buildings? Beginning with the oldest, we may dismiss the Egyptian immediately as too primitive. The Greeks are thought to have received their first ideas of architecture from the Egyptians, and they produced a very elegant and refined style. It will not do for us, however, for it does not make use of the arch. We cannot get along without the arch, nor can we do without the lintel. We must have a style that permits of the use of either or of both in the same composition. Let us remember the Greek architecture for its repose and dignity and for its beautiful and refined forms of columns, moldings and ornaments. The use of the arch naturally suggests the Gothic. This gives us a most scientific treatment of arches, and in vaulting surpasses all other styles. There are also new forms, quite different from the Greek, and yet reminding us of them in the way in which each molding is designed for the special place in which it is to be placed.

To me the Gothic is a charming style, and travelers will sing the praises of the Mediæval cathedrals as long as their buttressed vaults shall stand, but for modern buildings it is not what we want. Of stone vaults we have little use in commercial or residence architecture, and although the arch is indispensable the pointed form is not adapted to buildings with low stories and flat ceilings, and such must be the great majority of those we build.

"The American style must employ the semi-circular arch, it must tolerate the segmental and elliptical and must live on good terms with lintels of all sizes and descriptions. The straight line must be our main dependence. The curve we need for variety, but even then it must be a practical and manageable curve. There are two styles that employ the round arch—the Roman and the Romanesque; and if we are to find an inspiration from the ancients we must seek it here.

"The Greeks employed a system of tapered columns, carrying an appropriate entablature, and their buildings being one-story structures, this 'order' of architecture formed the whole building. The Romans adopted a modification of the Greek idea for their temples, but for most of their buildings they used the arched form of construction. They should, therefore, have an arched style of architecture, or their style should be a system of ornamental and ornamented arches. Now the Romans found the same difficulty that we do in inventing a new style of architecture, and they did what we do, took as a starting-point the work of their predecessors. They modified the Greek columns and then proceeded to apply them as ornaments to their arched construction. It did not occur to them that columns could be made to carry their arches instead of Greek architraves. They built piers to carry the arches and then set a column in front of each pier and placed an entablature on the columns. They thought their style of arched construction plain, but instead of inventing some logical method of ornamenting it they simply placed a screen of Greek architecture in front of it. This is the fatal weakness of Roman architecture which has been copied by all those who have been swayed by classic models to this day, as witness the design for the new Art Institute in this city, which seems to have been conceived on the theory that a building to contain Roman and Greek sculpture must not exhibit any development of architecture more modern than the days of the Roman Empire.

"Roman architecture is not a rational system of construction, but is two systems imperfectly united. It is a transitional period in which the architects sought to unite the orders of the Greeks with their own arches, but before the task was complete the Roman Empire had yielded to the conquest of our ancestors the 'barbarians.' This task of developing a rational system of decoration for an arched construction was accomplished by the nations of Western Europe, especially the French, and as a result we have

the styles we call Romanesque and Gothic." The author quoted from the *Century* Dictionary its article on Romanesque Architecture, as the richest in suggestion on that topic; which is as follows:

"'A general phrase, including the styles of round arched and vaulted architecture which prevailed in the West from the fifth to the middle of the twelfth century. The Romanesque can be separated into two distinct divisions. (*a*) That but little removed from debased Roman prevalent from the fifth to the eleventh century; and (*b*) the late, fully developed Romanesque of the eleventh and twelfth centuries which comprises the advanced and differentiated Lombard, Rhenish, Saxon, Norman and Burgundian styles. The latter division, while retaining the semi-circular arch and other characteristic features of Roman architecture, is in every sense an original style of great richness and dignity, always inferior, however, to the succeeding pointed style in the less perfect stability of its round arch and vault, the greater heaviness and less organic quality of its structure, the inferior flexibility of its design and the archaic character of its figure sculpture, of which much, however, is admirable in the best examples, particularly in France.' It was such a novel idea to me to find architectural criticism in a dictionary that I was led to examine further. I will give you only a few sentences: 'The architecture of the ancient Romans was characterized by the adoption of the Greek orders in general as mere external ornaments in lavishness of redundant and artificial decoration, and without understanding of their delicately studied proportions and logical arrangement.'

"'Mediæval architecture embodies a union of the Greek system of columnar construction with the Roman vaulting and arches, with the consequences flowing logically from the new combination. Despite local differences, Mediæval architecture represents a continuous development from the classical Roman to the modifications wrought by the Renaissance.'

"'While all Renaissance architecture is far inferior to Mediæval building of the best time, it represents a distinct advance over the debased and over-elaborated forms of the Mediæval decadence.'

"These views will probably not strike any of you as novel. The dictionary but condenses the generally accepted opinions of the best critics of art. The Roman architecture impresses us by its magnificence and by the beauty of its many forms, but it is lacking in the fundamental principle of architecture that the decoration must be an integral part of the construction. The Greeks followed this principle, and developed it for the column and entablature, but if we seek its application to the arch we must pass by the Roman to the Romanesque. The Roman or Classic style does not give us a rational system of 'decoration and decorated construction,' therefore it is not true architecture and cannot make a satisfactory basis for an American style. The Renaissance is in many ways better and more developed than

the ancient Roman. It borrowed much from the Romanesque and Gothic, but being wrong in principle no addition of foreign details can save it.

"Let us turn to the Romanesque and inquire what claims it has to be the foundation of our national style. First, it is a rational style. The system of ornamentation conforms to the construction and is inseparable from it. One reason for the failure of Classic architecture is its worship of the 'orders.' In a Greek or Roman temple the column with its entablature forms indeed the essence of the whole structure, and in our own days a porch to a building consists of columns supporting a roof, but in the practical buildings for our day and climate the column plays an insignificant part. You can't keep out the weather with columns, and in a climate where we have so much weather to keep out we must have a style of architecture that puts all architectural forms in their true place."

FRENCH ROAD-MAKING.

THE British vice-consul at Dieppe, in his last report, says that the roads which surround the docks and the national roads which lead out of the town on the east and on the west have been made with an exceptionally good quality of stone, of singular hardness and durability, which was brought from Cherbourg. In fact, it is so hard that it will cut glass. It is broken up into macadam, and forms splendid material for making roads. Her Majesty's Consul at Cherbourg mentioned this stone very favorably in his report for 1890, and its use has proved so satisfactory in Dieppe that the vice-consul thinks it might be worth inquiring whether it could be employed on some of our English roads, where a lesson in road-making might be learnt with advantage from the French "cantonnier." The material is usually marble, flint, stone or gravel, and whatever is used must be of the best quality and cleansed from all foreign substances. The stone must be broken up so that each piece may pass through a ring 2½ inches in diameter. It is then spread evenly over the road, the interstices being carefully filled in with smaller pieces, so that the whole is smooth and free from abrupt eminences and depressions. A steam-roller then crushes and levels the whole, after which a superficial layer of clay and earth completes the work. In Normandy, where the roads are perfect, they are made slightly convex, with a trench on either side, and are diligently scraped to keep them dry. One of the most important ingredients used in road-making is a little chalk, which helps to bind and consolidate the macadam or small stones into a firm and hard mass. If too much chalk were used it would render the roads sticky after frost.

CURIOSITIES IN EPITAPHS.

IN nearly every community throughout New England is located the old family burying ground. A large number, perhaps the majority of them, were established some time in the last century, and are between one and two hundred years of age. The style of architecture in the old-fashioned tombstone is remarkable for its simplicity as well as its great similarity. The quality of the stone was a coarse limestone or surface rock. The expense in the construction was in many cases vested in the inscription. Having occasion a few days since to visit one of these primitive graveyards, I became very much interested in some of the epitaphs engraved upon these headstones. They can be seen any day in the West Street Cemetery, Fairhaven, Vt. I give them to the readers of STONE just as I copied them:

"In memory of Ezra Hamilton, who died Feb. 25th, 1810, in the 77th year of his age."

Farewell, Farewell vain world
Farewell to thee,
For thou hast nothing
More to do with me.

Another one has this advice:

Frail mortals stop
And drop a tear,
Departed worth
Lies buried here.

This lasting marble shall declare
What sense and worth have ended here,
Where mourning friends will long repair
To ease their anguish with a tear.

The next one is striking for its originality:

Mortals behold as you pass by,
As you are now so once was I,
As I am now so you must be,
Prepare for death and follow me.

In the family burying ground in West Haven, Vt., are the following epi-

taphs which I obtained from Sarah's mother. It might be mentioned that Sarah was accidentally killed by her brother who was playing with the gun and "did not know it was loaded." Her father, the late Chauncey Benson, was the author of the following epitaphs of his children:

Sarah Harietta Julia Sophia
Was taken from this world
By a gun's awful fire;
In the hands of her brother
The gun it was held,
By the sad accident
Poor Sarah she fell.

Sleep on, my son Dewitee
Thy parents can't forget thee.

Laura Augusta Weltha Bertheiar
Is called from her parents to mansions higher.

It will be noticed that a number of names are added to these epitaphs, probably to fill out the lines. DeWitt was named after DeWitt Clinton, but the "ee" was undoubtedly added to his name in order to rhyme with thee.

In a cemetery of Hampton, N. Y., is a tombstone erected by a Thomas Hopkins, an Irishman, bearing the following inscription:

"Here lies two children dear
One in old Ireland and the other here."

A friend furnished me the following, which he copied from a tombstone in a churchyard in Scotland:

"Here lies me and my two daughters
We died from drinking Cheltenham waters,
If we had stuck to Epsom salts
We need not have been in these here vaults."

Pawlet, Vt., has an antiquated stone, containing an epitaph, that leaves the reader of it in doubt who the "departed in this life" refers to:

"In memory of Mrs. Perethene Butts, whom he enjoyed only three months, and then departed this life." "Date 1790."

George H. Harris.

THE NECESSITY FOR SUSTAINED EFFORT.

WILLIAM H. SAYWARD, well known not only as a promoter of associations among contractors and builders, but as a cultivated gentleman, who has studied the artistic as well as the social side of the question, delivered an address at Boston recently that, while directed to the builders, has indirectly a bearing that should suggest to almost every other trade the one thing needful—the necessity for sustained effort. In his address he said:

"One of the conditions most frequently met with in advocating the value of association as a solution for questions that can only be answered by the combined voice of those affected, is that of apathy. This is particularly true of builders as a class and is most likely to occur in localities where an unsuccessful effort at association has been made. Certain abuses, for instance, have existed in a given locality until they have become intolerable, and certain persons affected thereby have met together and formed an association for the eradication of these abuses. The association has been founded upon principles which are just and equitable and which are calculated to overcome and correct the evils aimed at. The enthusiasm of the members runs high, and in that enthusiasm the fact may be overlooked that persistent personal effort is necessary to the application of the principles advocated. The fact that the actual working members of any association are few, and that they are unable to immediately accomplish the change desired allows the enthusiasm of the greater number to cool, creating in its place a feeling of apathy on the part of the entire portion of the community affected, with possibly a few exceptions. In all efforts for the reformation of established customs a certain amount of enthusiasm is necessary and the mark must necessarily, also, be placed high, but simply because the gathering together of a class of men into an association and the promulgation of just principles does not bring about immediately and entirely the desired reform, is no cause for discouragement or apathy.

"The failure of abuses to immediately correct themselves upon the announcement that an association has been formed for their correction, is no cause for surprise or disappointment, but is too often the cause of complete oversight of the little things which indicate that the leaven is working. The leaven in this case is the few who in their earnest efforts at correction refuse to submit to the abuses in question, and who are often thereby placed

at a disadvantage to those equally interested with themselves. Because every architect will not use a certain form of contract, and all workmen will not accept certain conditions of labor immediately upon the same being announced by an association of builders, is no sign that ultimate compliance could not be obtained. When a builder is awarded a contract he sticks to it until the end under every adverse condition that may arise, for he knows that persistence brings the result for which he is striving. At a certain stage in the work he receives part of the result and at another stage he receives more of the result, and so on until the end, when he receives full payment. It is exactly the same with an effort to bring about better conditions for the transaction of his business, and the result is quite as necessary to his welfare and success as that of his completed contract. If the reputable builders of a community associate themselves together for the purpose of securing the conduct of their business upon a more fair and equitable basis, and apply the same steady, persistent effort that they do to the execution of their contracts at a certain stage in the work, they will receive the result, first, in the form of a recognition of their efforts; at the next stage, in the compliance of a few with the changes desired, and so on until the reform has become general and the full payment is gained in the establishment of new customs which greatly facilitate the transaction of their business. The builder cannot, for instance, secure the establishment of a desirable form of contract in general use unless he refuses to sign any other, and so long as he makes no effort to have his brother builders refuse to sign any other, so long will he be obliged to submit to conditions which are irksome.

"There are cities in the United States to-day in which the builder conducts his business in a manner both unsatisfactory and unprofitable. He submits to conditions which would not be tolerated in any other vocation, and resorts to methods to secure business which are unjust to himself and which cut down not only his profits, but the dignity of his calling. He is apathetic so far as any actual well-directed attempt at the correction of existing evil practices is concerned, for lack of determined and sustained effort on his own part as an integral part of the community affected. Every builder is willing to work for the securing of a contract; he does it in the regular course of his business, and he should be equally willing to work for the securing of conditions and practices which would facilitate its transaction and enable him to carry it on at a greater profit. That work which will bring about the result so manifestly to be desired, and which up to the present time has proven most efficient, is association, backed up by well-directed, persistent and untiring effort on the part of each individual member. This effort need not in the least degree conflict or interfere with business, but can be made a part of its transaction. The only motive for de-

parting from the rules and principles laid down by the association would be the securing of a contract at an unfair advantage over some other member of the association, and so long as the association as such maintained its principles the work of improvement would go on. It should be remembered, in considering the actual results of associated effort, that the customs attacked are the outgrowth of many years of neglect, and must not be expected to transform themselves. They will only yield to years of persistent and sustained effort at their transformation."

WILLIAM L. SAUNDERS.

THE subject of the portrait in our frontispiece is of one whom all readers of STONE are well acquainted with through the fellow-feeling that "makes us wondrous kind." One who does not teach, but tells what he knows in that simple way that turns pupils into friends; like two sponges exchanging moisture, one surcharged, the other dry and absorbing the surplus that the other gladly parts with—complete congeniality. It is an excellent likeness of Wm. L. Saunders.

He was born in Columbus, Ga., in 1856, the son of Rev. Dr. Saunders, of Virginia, who was nephew of Robert Saunders the celebrated professor of mathematics who became president of William and Mary College, at Williamsburg, Va. The ancestry dates back to Edward Saunders, in 1716, who was one of the celebrated "Knights of the Horseshoe" of the Old Dominion. On his mother's side he was descendant of Walter Morton, of Ayrshire, Scotland, and who was a cousin of Robert Burns.

Wm. L. Saunders was "brought up" on the Gulf of Mexico, in Florida, and educated by his father. He went to Philadelphia in 1872, and entered the scientific department of the University of Pennsylvania. He graduated as civil engineer in 1876, and while at college was first editor-in-chief of the *University Magazine*, and was class poet. The effect of this training is still visible in his contributions to the technical press. He also was Philadelphia correspondent for Southern newspapers during the Centennial Exposition at Philadelphia. Mr. Saunders began his professional life as civil engineer in charge of hydrographic work, as building ship channels, dock building and general hydrographic construction. While excavating ship channels he introduced improvements in machinery for blasting rock under water, and was the first to introduce a water jet following a drill bit into the hole. [His work in this line is described in "Farrow's Military Encyclopedia," under title of "Submarine Drilling;" also in Eissler's work on "Modern High Explosives."] He was

engaged as engineer for the Ingersoll Rock Drill Company, in 1882, and conducted experiments in marble quarries in Vermont. While there he designed and patented the channeling and gadding machines now largeally used in quarries, known as the "Ingersoll" channelers and "Ingersoll" gadders. He also designed the first commercially successful direct-acting channeling machine.

In 1886 he married Miss Gaston, daughter of Commodore Gaston, at Narragansett Pier, R. I., and two children have followed as the result of the union.

He was elected to a membership in the American Society of Mining Engineers, the American Society of Mechanical Engineers, and the American Society of Civil Engineers and Engineers' Club in New York, in which he still retains membership.

He has written much on quarrying, as readers of STONE know, and also written and lectured both on compressed air and quarrying. He now holds the office of secretary and manager for the Ingersoll-Sergeant Drill Company. He also is an officeholder, having been elected Mayor of North Plainfield, N. J., last spring. His character needs no description. It is well outlined in his career and its successes.

WILL TOW FREIGHT TRAINS ACROSS LAKE MICHIGAN.

A CURIOUS, and almost startling project is recorded by the *Railway Age*, where it will be attempted to ferry loaded freight cars across Lake Michigan between Frankfort, Mich., and Kewaunee, Wis., a distance of 52 miles, connecting the Toledo, Ann Arbor & Northern with the Green Bay, Winona & St. Paul Railway. A large propeller is under construction at Toledo, which will have a capacity of 21 cars, and it is expected to tow a barge carrying 15 cars, making 36 cars, or more than an average freight train. The cost of transferring grain and other freight from cars to steamer and from steamer to cars forms a very heavy item of cost which the proposed plan, if successful, will save. Lake Michigan, however, is a treacherous water and considerable risk will be involved in ferrying cars across it, especially in winter when ice abounds.

QUARTZ.

FEW minerals are more common, and fewer still more beautiful in their various forms, than quartz. Compounded as it is of the two most abundant elements in the world, silicon and oxygen, it is found in some form or other in almost every locality, and often occurs in shapes and colors rivaling the less common minerals usually ranked as gems.

Quartz is chemically a silicic anhydride, with the formula SiO_2. In its purest form it is a colorless, transparent solid, resembling glass, and crystaltallizing in the hexagonal, or six-sided, system. The ordinary form of quartz crystal is familiar to every one, and consists of a six-sided prism surmounted by a six-sided pyramid. In the perfect crystal both ends should be terminated by pyramids, but such specimens are rare. These crystals are found of all sizes, from those scarcely larger than a pin-head to those weighing several pounds.

Beautiful as the pure rock crystals are, there are other forms of quartz which are still more beautiful. A remarkable property of quartz is its capability of absorbing different coloring matters, thus imitating the different precious stones, and often only to be distinguished from them by the eye of an expert. Yellow, red, purple, blue, green, and all the different shades of brown and black have been observed, and the terms *false* topaz, ruby, emerald, sapphire, etc., are applied to these specimens, in distinction from the true, or *oriental*, gems, which are distinct mineral species; while the massive white milky quartz and the rose-tinted variety are even more common than the above-described forms.

Every one is familiar with the beautiful stones known as *agates*, which appear to be made up of different bands, or layers, greatly varying—even in the same specimen—in form, size, and color. There are few more beautiful natural objects than a finely polished agate, and the infinite variety which they present prevents one from ever wearying of them. The method of formation of agates is an interesting chapter in mineralogy. Silicic anhydride, or silica, as commonly found in the shape of quartz, is an extremely insoluble substance, neither water nor most chemical substances having any action upon it. It can, however, be made to unite with alkalies, forming soluble silicates; and by a somewhat complicated manipulation these silicates may be decomposed, and the silica obtained in solution in water. It is rather doubtful if this is a true solution—like that of salt in water, for instance. Silica formed in this way is a *colloid*, or jelly-like, substance, and the so-called solution may be more analogous to a weak jelly or glue. But for all practical purposes it is a true solution of silicic anhydride in silica, and, although only made artificially with some difficulty, it often occurs very

abundantly in the waters of certain mineral springs—notably those of the Yellowstone Park, which in a short time encrust all objects placed in them with a coating of silica.

Having understood this matter of soluble silica, the formation of an agate becomes very plain. They are usually formed in cavities in the rock, and more often in limestone strata, as this formation contains more cavities than any other. We have only to suppose a stream of water containing silica in solution to flow through such a cavity. In the course of time the silica will be precipitated from its solution and deposited upon the walls of the cavity, either as translucent massive quartz or the beautiful rock crystals; or, as often happens, it will retain as it hardens its original jelly-like appearance, forming the mineral known as *chalcedony*. The resemblance of chalcedony to a petrified jelly is remarkable, and is a conclusive proof of the method of its formation.

In the course of ages the cavity in the rock may be filled and emptied many times. Impurities may be present in the water, which are precipitated with the silica, imparting to it various colors, and, by successive deposits, producing the banded, or stratified, appearance of the resulting agate. Not infrequently the opening to the cavity becomes stopped up, or the supply of siliceous water fails before the cavity is completely filled with the hardened quartz. We then have a hollow, more or less spherical piece of quartz, which, when broken open, is found to be studded on the inside with crystals, agates, chalcedony, and other varieties of the mineral. These are known as *geodes*, and form some of the most beautiful specimens in mineralogical collections. They are extremely abundant in the limestone regions of the West.

Moss-agate is a form of agate containing markings resembling fern leaves or other vegetable matter. These are not petrifactions, but simply crystals of manganese and iron salts which have been deposited in arborescent forms. Occasionally pieces of quartz are found which contain cavities filled with water, thus furnishing additional proof of the aqueous origin of the specimen. Some crystals also contain minute cavities which, strangely enough, appear to contain liquefied carbonic acid gas. It is hard to understand how it could be inclosed in the mineral under such tremendous pressure, except by assuming that such specimens were formed in some way by the action of volcanic phenomena. We may also mention that minute but true crystals of quartz have been observed to form in modern times upon the timbers of a mine, over which a stream of siliceous water trickled.

In their natural condition, agates are usually dull, unattractive stones, which few people would take the trouble to pick up. The trained eye of the collector, however, recognizes them at once; and by a laborious process of grinding and polishing, the true structure and beauty of the stones are developed. A few agates are polished in this country, but most of this work

is done in Germany, where, on account of the cheapness of labor, the fatiguing work which the process demands can be accomplished at a moderate cost. "Tricks of the trade" are not unknown, even in this art, and comparatively poor stones often have their color improved and rendered more brilliant by successive baths of oil and sulphuric acid.

Jasper is a variety of quartz which only differs from agate in being opaque instead of translucent. It is simply a coarse, impure agate. Cornelians, blood-stones, rhine-stones, and many other semi-precious stones are only quartz in different forms and colors. The best simple test for such stones is their comparative hardness. Quartz is somewhat harder than glass,—that is, it will scratch a piece of glass,—but the diamond and the oriental, or true, precious stones are much harder than quartz. Therefore, unless an alleged diamond, ruby, or sapphire will easily make a scratch upon a piece of rock crystal, it should be viewed with great suspicion, and submitted to an expert for more conclusive tests.

The only real precious stone belonging to the quartz family is the opal. This is a distinct variety, somewhat softer than rock crystal, and containing a small percentage of water. It is often most beautifully colored, and is very highly prized by lovers of gems. It sometimes contains fibers of asbestos or other minerals, which, by causing diffraction and interference of the light-waves, produce most gorgeous scintillations of prismatic colors. The variety of opal known as "cat's eye" is made up in this way.

In its most common form of ordinary sand, quartz is an important and valuable natural product, especially to glassmakers, who make use of it in immense quantities; but the more ornamental and less useful members of the family described above will always attract the most general admiration, and may be properly classed among the aristocracy of the mineral kingdom.—*Popular Science News.*

THE INSPIRATION OF MEDIÆVAL ARCHITECTURE.

MR. BARR FEREE, whose lectures on architecture have several times been reproduced in this magazine, recently delivered one before the American Society of Church History, on "Christian Thought in Architecture." It was an analysis of the emotional and intellectual inspiration of the Gothic, and is especially instructive as showing the necessity for a controlling unifying ideal in the production of really harmonious and artistic construction. This æsthetic element has become visible in recent years in the predominence of the Romanesque, and its combination with other forms essential to the production of a harmony adapted to modern utilitarian needs. Referring to the emblematic way the teachings of Christianity were made clear to a people who could not be made to understand them in any other way than through sculptured stone and inspiring architectural combinations, Mr. Feree continues:

"Sculpture reached its highest development in the choir screen and the portals. The history of the choir screen is a most interesting study in evolution. Originally the basilica, designed as a means of separating of the inferior clergy and singers from the congregation—a signification it has retained to the present day—it was a simple low wall, whose richest ornamentation was a geometrical design in mosaic, and whose most imposing features were the ambones or reading desks for the gospel and epistle, which formed part of their construction. In the Mediæval cathedral this simple structure had grown from these elementary proportions to massive walls of stone or marble, often ten or fifteen feet in height, and ornamented with elaborate sculptures and other decorations, the whole forming an architectural combination of the most impressive kind. Here the Mediæval artist told the story of the patron saint of the church, or set forth the episodes oi the Virgin, or depicted some scripture incident in forcible and effective sculptures. Perhaps the most famous of the works, and certainly the most beautiful and elaborate, though dating from the fifteenth to the beginning of the eighteenth century, is the choir screen of the cathedral of Chartres, representing scenes from the life of Jesus and the Virgin. A long series of designs inclosed in an architectural framework of arches, pinnacles and tracery of almost lace-like delicacy extends around the choir. The cathedral of Amiens has a screen with similar though less numerous sculptures, illustrating the story of St. Firmin, the patron saint of Amiens, and the life of

St. John the Baptist. Nothing more useful and beautiful than these screens, which exhibited, in language that all could understand, the truths of the Bible and of the Church, is to be found in the whole range of Gothic art. With their graphic illustrations of sacred themes they offer a marked contrast to the walls of the choirs in English churches, which are chiefly ornamented with monuments to departed individuals or with Gothic tracery, which, while beautiful in itself, is quite without the real living Christian interest of the French screens.

"Like the entire facade, the portals were designed on an elementary basis. Sometimes the outer opening was flush with the main walls of the church, sometimes they projected beyond it, while in occasional instances, as the lateral doorways of Chartres Cathedral, they are prefaced with a porch. The entrance was deeply recessed, the columns supporting the arches from the roof having statues in front of them or between them. The whole design was in a measure subordinate to the central sculpture in the tympanum over the door, or perhaps it would be more proper to say all the sculptures led up to this central feature. Various subjects occupied this space, the most usual being a representation of the last judgment. No single piece of sculpture of the middle ages is more impressive than the last judgment of the great portals. The entire doorway is, in fact, given up to representing this most awful event in Christian theology, which effectively warns all of the wrath to come and the dangers of a worldly life. The scenes of the last jugment itself are shown on the tympanum, but the entire inner surfaces of the arches that form the portal are covered with figures of cherubim and angels, the hosts of heaven, who appropriately occupy the most lofty position. Sometimes scenes from the life of the Virgin, or some other events in sacred or legendary history fill the tympanum, but the last judgment is the topic most often employed and the most appropriate. Though of very great variety and individuality, there is much similarity in all these conceptions which are widely distributed in the Romanesque and Gothic cathedrals and churches of Europe. Christ, the judge of the world, is enthroned above, with St. John and the Virgin or attendant angels on either side. Below, the center is occupied by an angel weighing the souls of the departed. On one side is a hideous Satan ready to seize the condemned, and who hands them to his minions behind him, who pass them on to the fiery pit, represented by a cauldron over a fire vigorously fanned by devils with bellows. On the other side are the blessed, and in the lowest division the dead rise from their tombs. It is a close and graphic transcription of the scene described in the Gospels.

"Thus the Church taught the truths committed to its care; thus the Christian was reminded of the cardinal facts of his religion in all the parts of his church building. The structure itself, not less than its decoration,

made one great whole that was the product of Christian ideas, the outcome of Christian faith, the expression of Christian truth.

"The indication of Christian thought in architecture is no fanciful product of the imagination. Christianity, its forms, doctrines, ceremonies, lay at the foundation of Christian church architecture; its influence upon the art was persistent and marked until the beginning of the Renaissance. It is not something that needs to be searched out, for it exists in the most evident manner. Christianity exercised quite as much influence upon the development of architecture as did progress in construction, or the social and political state of the builders. Apart from this, the study of architecture from this standpoint directs attention to the wonderful illustration of Christian ideas in the great churches of the thirteenth century, in which the architectural manifestations of Christianity reached its culmination. Yet it is well to remember the limitations; Christianity then received its most complete aachitectural form, but this was not because it had reached its highest stage of development as a religion or as a social factor. The era in which this point was reached was, as has been shown, an architectural one. The art quality was of unsurpassed refinement, but it was due to the nature of the time, to the especial things which occupied the minds of the people, and other characteristics that formed the distinctive civilization of the age. Christianity as a religion unquestionably inspired architects, sculptors and painters to put forth their best efforts and eclipse all known ideals; but it was because art and religion both held a greater share of popular thought in the middle ages than at any other time that Christian architecture of the form and style known as Gothic so thoroughly and completely illustrates Christian ideas."

COMPOSITION OF MASTICS.

MASTIC is a substance which is generally considered to be a composition of finely ground oolitic limestone, mixed with sand and litharge, and to which has been added a portion of linseed oil. Its composition, however, is quite variable; it has also received the appellation of a metallic cement. In small quantities its usage is similar to that of common mortar, in pointing up the joints of stonework and in patching up disintegrated walls. Many of these mastics contain a certain proportion of metal, iron, zinc, lead, etc., whence their name.

The composition of Fontenelle mastic is stated as follows: Two parts, by weight, of oxide of zinc, two parts of very hard calcareous stone passed through a sieve of .06 of an inch, and one part of crushed sandstone or quartz rock. The whole is mixed as it is served, and colored with a little ochre or carbon black, of which the weights should be deducted from the quantity of stone employed. Then dissolve clippings of the zinc freshly cut in commercial hydrochloric acid up to the point of saturation. Then add to the liquor thus prepared one-sixth of its weight of zinc dissolved. This is allowed to settle and the supernatant liquor decanted. Then add two-fifths of water, by volume, to the liquid thus prepared. We have, as a result, a liquid and a powder, which united make the cement. It is to be applied quickly to the stone surface, pricked or lightly roughened and brushed. It takes about one pound of the powder to one-third of a quart of the liquid. At the last moment the stone is moistened with the pure liquid, the cement is then applied and set with a trowel. The operation is performed in about twenty minutes. When the part to be mended measures more than two inches in thickness, it is found to be economical, and yet not detrimental to good work, to convert the cement into a concrete by adding pebbles; the pebbled surface may be afterwards bush-hammered to a uniform surface.

The cement Fontenelle, so called from its inventor, has been improved by M. Warest, of Paris, Superintendent of Bridges and Highways, who has given to it the definite composition cited above. It is resistant and inexpensive. On a large scale it has been employed in different undertakings, notably on the Pont Neuf at Paris, where the cornice is made of it. The results obtained are stated to be satisfactory.

"Filings Mastic" is made as follows: Take three-sevenths, by weight, of

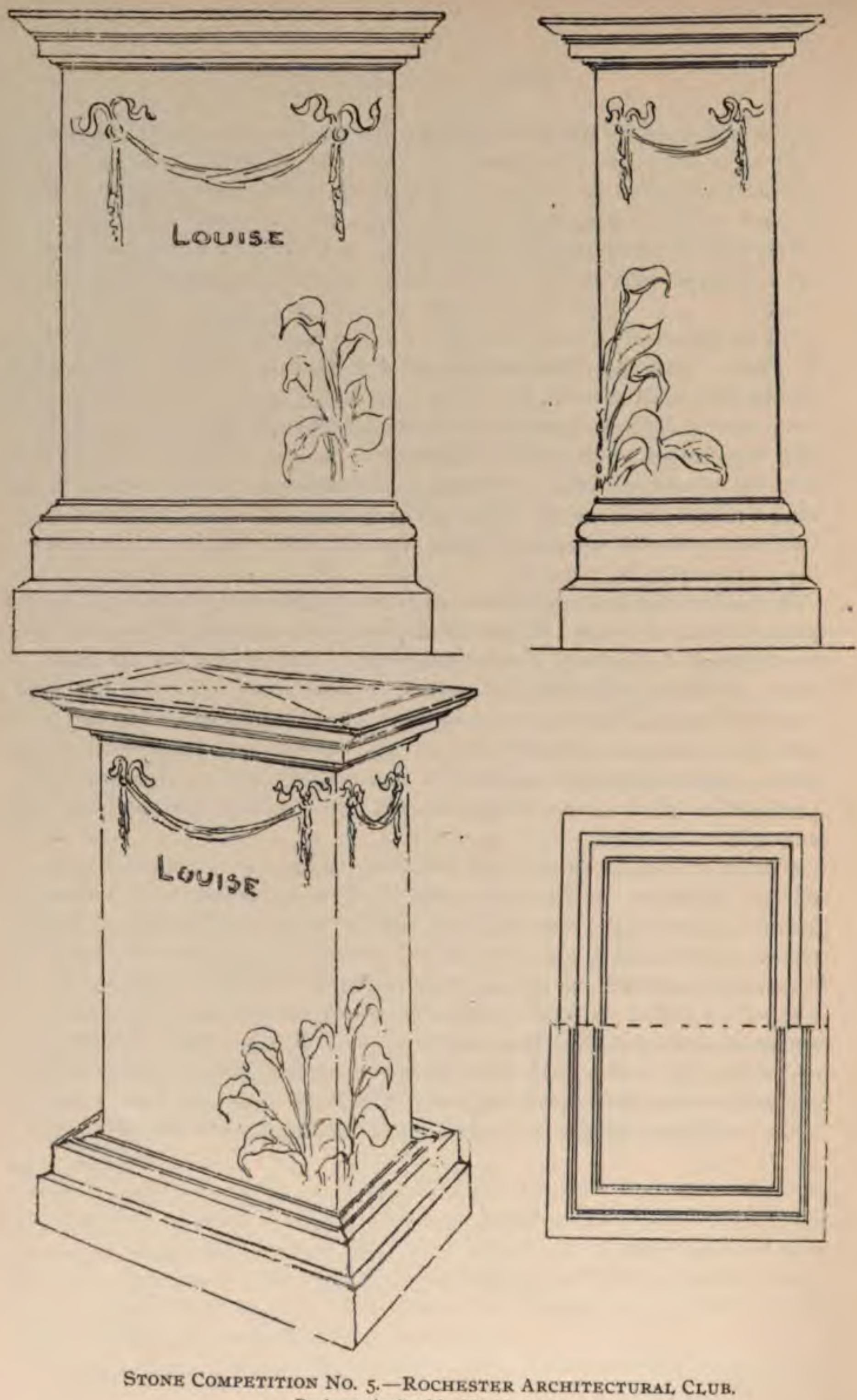
pulverized stone (as much as possible like the stone that is to be repaired, both as to color and characteristics), two-sevenths of the stone to be added slowly, three-sevenths of the cast-iron filings or the same amount of copper. It goes without saying that the iron filings are the more economical. Triturate these three substances with care, so as to arrive at a complete mixture, then moisten with water, little by little, after the manner of mixing fine plaster.

"This last cement," says M. Daly, "has given excellent results at the Hotel de Ville, of Quenosy (North), where MM. F. Guilleman and L. Laubser have employed it with success."

It is not sufficient, writes Mr. C. Powell Carr, in *Architecture and Building*, that the cement, or the mastic, whatever it may be, should be good by itself, that is, economical, easy to employ and resistant. It is necessary, also, that it adheres well to the stone. The precautions to be taken are to see that the surface be scraped, brushed, washed with water or oil, according to the treatment to be pursued.

Sometimes the stone to be treated is thoroughly disintegrated, and patchwork becomes difficult. Where the disintegration has pierced to some depth, the reparation becomes almost impossible. When not too far gone, the rotten surface is superficially hardened by sizing the surface by the Faure-Kessler process. Excellent results have lately been obtained in this direction, when its operation is to restore the cornice and balustrade of some public edifice, originally executed in some friable stone of inferior quality, particularly in stone-work where exposure to frost and weather have wrought the damage.

The most important binding materials in mastic cements seems to be oil and litharge. In many cities where inferior brickwork is coated with mastic and forming a veneering of artificial stone, the cupidity of the contractor almost always shows in the excessive proportions of sand to the cementing material. If not properly mixed, although well put on, the disintegration begins in spots irregularly spaced, and the surface presents an appearance of crumbling here and there, or as if it had been punctured by tiny drills. If well mixed, but improperly applied, the veneering indicates the bad work by flaking off in spots. The latter phase of flaking is sometimes caused by using an excess of oil in coating the brickwork.



STONE COMPETITION NO. 5.—ROCHESTER ARCHITECTURAL CLUB.
Design submitted by W. M. Perrin.

THE PORPHYRIES OR PORPHYRITIC FELSITES.

THE term porphyry, as properly used, refers simply to the structural features of the rock, and does not in itself alone indicate any particular kind of stone. It denotes that throughout a mass of rock of quite even texture are distributed numerous crystals of a mineral which having been the first to assume crystalline form, on the cooling of a molten magma, are larger and of a more perfect outline than those which formed subsequently. This structure is very common in many granites, but is not particularly noticeable, owing to the coarse crystallization of the stone and the nearly uniform color of most of the constituents. Occasionally, as in the well known Shap granite from Cumberland in northern England, the large porphyritic feldspars are of a flesh-red color, while the main mass of the stone is but gray, or pinkish, and the contrast is, therefore, very striking.

There is, however, a class of rocks in which the mass of the rock, the *groundmass*, as it is technically called, is so dense and compact as to seem practically amorphous or none-crystalline, and in which are imbedded large, scattering, quite perfectly formed crystals, usually of quartz of felspar. These large crystals, being of a different color from the groundmass in which they lie, stand out in marked and often very beautiful contrast. It is to rocks of this nature that the name porphyry has in times past been chiefly applied. According to Hull the name was originally applied to certain kinds of igneous rocks of reddish or purple tints, such as the red porphyry of Egypt. Be this as it may, the term is now used mainly in its adjective sense, since any kind of rock may, under certain conditions attending crystallization, assume this structure. We thus have porphyrytic granites, diabases, diorites, felsites and even limestones. Nevertheless there is a group of igneous rocks closely related to the granites in chemical composition in which this structure is so characteristically developed that the names quartz or felspar porphyry, or porphyric felsite, are often applied to the entire group.

Accordingly as these porphyries vary in mineral composition they are divided into two principal varieties: (1) Quartz porphyry, which consists of the fine-grained groundmass in which quartz alone or quartz and orthoclase are porphyritically developed, and (2) quartz-free or orthoclase, in which orthoclase alone prevails, no quartz appearing either porphyritically or in the groundmass. This last variety, it will be seen, bears the same relation

to the quartz porphyries as does syenite to the granites. Through an entire disappearance of the porphyritic crystals, the rock passes into felsite. The porphysies bear the same accessory minerals (hornblende, mica, etc.,) as do the granites, but these are usually in such small particles as to be invisible to the naked eye.

Porphyries, like granites, are of a variety of colors; red, purple, gray, green, brown and black of a variety of shades are not uncommon, and when, as is so often the case, the porphyritic minerals contrast in color in a marked degree with the groundmass, the effect on a polished surface is very beautiful.

The porphyries are as a rule intensely hard, tough and without rift or grain. As a consequence they are scarcely at all used in this country, although among the most beautiful and indestructible of our rocks. The celebrated porphhries of Elfdalen, Sweden, are wrought into a variety of objects of art, and with exceedingly beautiful effects. Visitors at the Centennial exposition in Philadelphia will recall the beautiful large column and inlaid table of this stone that were there displayed.

Inexhaustible quantities of porphyries of a variety of colors and great beauty occur at Saugus, Malden, Lynn and Marblehead, and other localities in eastern Massachusetts, but which have never been utilized to any extent owing to the cost of working. Many of these are of exceptional beauty, presenting colors red as jasper, through all shades of pink, gray and even black, often beautifully variegated and brecciated in a variety of colors. Flow structures, caused by the onward flowing of the rock while in a partially cooled condition, often gives rise to a beautiful banding and interweaving of colors impossible to decribe, and which must be seen to be appreciated. The striking beauty of this flow structure is sometimes heightened by the presence of angular fragments of variously colored portions of the rock, which, becoming broken from the parent mass, have been imbedded in a matrix of quite different color, as at Hingham, where the writer has found bright red fragments imbedded in a yellowish paste. The rock acquires a beautiful polish, and the fact that it has not ere this come into more general use is a sad comment upon the taste of our wealthier citizens. Nearly as indestructible as glass, and as beautiful as an agate, it is yet almost wholly ignored except for purposes of rough construction.

A large variety of porphyries, varying in color from black to red, occurs also in New Hampshire, particularly near Waterville, some of which would make fine ornamental stones. At Franconia, in the White mountains, there occurs a porphyry conglomerate formed of fragments of jasper-red porphyry closely cemented into a compact rock, which is particularly beautiful.

Porphyries are abundant in many other states, but are scarcely at all used.

Maine, Pennsylvania, Missouri, Minnesota and Wisconsin all contain good material, though, as little or no search has been made for the highly orna- varieties, it is impossible to say what they can produce.

At Green Lake, in the last named state, there occurs a beautiful rock of this class, almost black in color, with white porphyritic felspars. It has been quarried to some extent near the town of Uttny, and polished columns of it may be seen in the German-American bank building and Union depot at St. Paul, Minn. It is greatly to be regretted that no economic method of working so beautiful and durable material has as yet been discovered.

Near Charlotte, in Mecklenburgh county, N. C., there occurs a very light colored, almost white, quartz porphyry, which is penetrated by long parallel streaks or pencils of a dead black color. These are so arranged that, when cut across, the surface appears studded thickly with roundish and very irregular black points of all sizes up to half an inch in diameter. Cut parallel with the direction of the pencils, the surface is streaked with black lines, which sometimes assume beautiful fern-like or dendritic forms.

The rock is intensely hard, tough and without definite rift. It can, therefore, be worked only at great cost, and is not regularly quarried. It has been used only locally for rough purposes, as for curbing, steps and sills. An analysis of this rock is given in the tables.

A deep reddish quartz porphyry, somewhat resembling the Egyptian red porphyry, has been reported by the United States geologists as occuring near the great bend of the Carson river in Nevada.

From the Isle of Hoghland, in the Gulf of Finland, the National museum has received a variety of quartz poryphyries. These have mostly a dull red, very compact base, and carry large, nearly white, pinkish or reddish felspars and glassy quartz in great profusion. The rocks acquire a good surface and polish, but are intensely hard. Other porphyritic and compact rocks, variously called diorites, keratites and porphyries, were received from the district of Katharienburg, in the Urals, as noted in the published catalogue of the collections.

THE PARTHENON FRIEZE.

AN ATTENTIVE examination of the various parts of the frieze will show that very different degrees of skill and feeling have been employed in the execution; while it can scarcely be doubted but that the arrangement of the whole composition and the design of the different parts have been the work of one mind. If the various parts had been actually modeled by the original author of the whole composition, it is probable that

the whole would have been worked up to the same degree of excellence, and with the same attention to the details of the finishing. But this is very far from being the case. Upon some the perfect knowledge of the anatomy, all the framework of the body, all the intricate arrangement of the muscles, with their expression and modification under excitement varying in intensity and direction, are clearly understood and indicated without exaggeration. Upon others all these are generalized and neglected, as if not fully comprehended; and we are, therefore, inclined to believe that different portions of this frieze were intrusted, for their execution, to different artists, who were to exert their best abilities, being furnished only with an outline or sketch of the part committed to them. The immense extent of the work to be performed renders this conjecture probable; it is almost necessary that the design should have emanated from one mind; but it is almost impossible that one pair of hands should have modeled so extensive a work, when we are told that the whole empire, with all its sculptures, pediments, metopes, frieze, as well as its internal decorations, and the stupendous statue of the goddess herself was completed, from its foundation, in little more than six years. Doubts have been entertained whether the separate slabs of which the frieze is composed were sculptured in the private studios of the several artists, and afterwards adjusted in their places, or whether the slabs were first placed, and the artists then set to work to execute their respective portions. When it is recollected that these sculptures were very peculiarly placed, so as to receive only a light reflected from the pavement below, so very different from what the artists could conveniently arrange in their own rooms; that the general effect would very materially depend upon the correct adjustment of the depression and elevations of the surface to the peculiar direction in which the light was to be received, and to which it is to be supposed that the artists would be but little accustomed, it is more than probable that the sculpture was executed after the marble was already fixed in the walls of the temple. If, again, we examine the nature of the composition, especially of those parts where the cavalcade is represented; if we look at the intricacy of the arrangement, the crowding together of the figures, the blending of the subjects of the adjoining slabs, it is difficult to conceive how one part should have become fitted to another with that perfect accuracy which we may everywhere observe, unless the sculpture had been executed when the slabs were already placed, or the whole had been accurately modeled before the work was commenced, which we have already seen reason to believe was not the case.—*The Architect.*

SOLDIERS' AND SAILORS' MONUMENT, ROCHESTER, N. Y.
[*Illustration by Courtesy of The Union and Advertiser*]

RUINS OF ANCIENT COPAN.

LETTERS received by Professor Putnam from men in charge of the Harvard expedition in Honduras, now investigating the ruins of the buried city of Copan, show that the excavations are turning out most interesting material, and that the results fully justify the expedition. There is, perhaps, nothing stranger, either in history or fiction, than the past of these forgotten races, who live now only because they left their mementoes cut into the nearly imperishable stone. Rider Haggard has for a year past been exploring the vestiges left by the ancient race that once inhabited and civilized Central America. What his genius will fail to unearth by patient research (for he is a scholar in the highest sense, both in archæology and as a linguist of Oriental languages) he will supply out of his own fertile imagination. But it will require imagination fortified by patient research to produce a picture out of the past equal to the story that the ruins and sculptures tell.

The work of uncovering these ruins, upon which the dust of many centuries has fallen, is now being conducted at the southern end of the main ruin near the large pyramid, says the New York *Times*. Here several tombs have been unearthed from beneath a mass of debris. The tombs themselves are constructed from cut stone, and in them were found fragments of skeletons almost wholly decayed. Enough of them, however, are left to show some important facts. Among the fragments were some skulls which indicated a custom of filing the teeth in various shapes. Some of the teeth were drilled, and in the holes so made were set green and blue stones.

A small mound near the center of the ruins, on the banks of the river Copan, was at last accounts being explored, and here skeletons were discovered, but without any ornamentation of the teeth. This apparent difference in the manner of burial between those found in the tombs and in the mounds may be explained, perhaps, by the fact that the latter seem to be better preserved, and may belong to a later people; but all this is conjecture, and nothing will be known for a certainty until the excavations are carried further and the report of the winter's work is made.

The city of Copan is about two miles long, and all about it are fragments of ruins. Great monoliths covered with glyphs of all sorts have been erected in many places about the city. Some of them, long ago fallen in the dust, are some distance from the main ruins. The sides are covered with grotesque figures of feathered serpents, human heads, mostly of the

Indian type, dragons with human faces, and circles and lines. In front of these huge, carved stones are usually what are supposed to be large altars. Some of the great figures of human heads found were evidently used as incense burners.

Moulds are being made of the large monoliths about the ruins, so that the casts of the large and singular carvings can be set up in the Peabody Museum at Harvard. Many pieces of interesting sculpture have been found, of which photographs have been taken, as well as of the monoliths and portions of the buildings showing carvings.

The great temple is the point of greatest interest. Here were celebrated all the religious rites of this strange people, and here, perhaps, human beings were offered up in sacrifice to their gods. One of the most interesting parts of the temple is the inner chamber, as it is called. On the face of the step below the doorway leading to this are hieroglyphics composed of the characteristic faces, dots, lines and serpents. Over the doorway and about the sides are fantastic figures crawling through a number of letters, or figures, shaped like the letter S laid on its side. On the lower parts of the sides of the doorway a figure like Atlas supports the other forms. No one has yet interpreted the meaning of these inscriptions. The language of the people is yet to be unfolded to the world. The problems and the life of those days remains for some philologist to restore to the present and make the stones of Copan tell the wonderful story of its rise, progress and decay. The work of Harvard College will do much to bring this about.

There have been many diverse opinions about Copan and its antiquity. The German scholar, Dr. Julius Schmidt, claims the ruins at Quirigua are older than those at Copan, and that they are, in fact, the oldest on the American continent. He looks upon it as reasonable to suppose that the sculptors of Palenque, Ococingo, Copan and Quirigua were all of the race of Mayas. The monoliths are, he says, both at Copan and Quirigua, of a religious character, and have altars in front of them, plainly pointing to sacrifices to the persons represented on the monoliths. Schmidt regards the low-relief figures as the oldest. The stones for these great monuments and buildings were quarried in the mountains two miles away.

FOR THE IMPROVEMENT OF COUNTRY ROADS.

SO much attention is now directed to the problem of improving the country roads, that all practical suggestions on the subject are of general interest. William H. Smeaton, M. E., in the *Engineering and Mining Journal*, sums up the general conditions in the most practical manner, in the following:

"The requirements in the case are not to lay out in this country, as in a new one, a system of roads that shall be perfectly straight and diverging directly from populous centers to agricultural districts; that shall be perfectly smooth and therefore constructed of the hardest material obtainable: and that shall be so constructed that the maximum grades in passing over hills may fall within limits scientifically prescribed; all this can be found in the standard engineering books on the subject of road building—but they are to economically remodel the existing highways, many of which are in a deplorable condition, that our internal transportation may be accomplished at greater speed and at less cost than at present.

"According to my ideas, it may be accomplished in a manner which I will treat under two heads—the practical and the legal.

"*The Practical.*—Under this head the first point to be considered is that of economy, and there is throughout the New England and Eastern states, particularly, a most economical material at hand in the form of the stone walls that line the highways.

"I propose, therefore, that this stone be used to remodel the roads and cheap rail fences be erected instead. The usual custom of crushing the stone to pass through a three-inch ring, and depositing the screened stone several inches thick on the road-bed, with the fines on top, then rolled, should not be followed, but the large stones from the wall should be placed directly upon a carefully cleaned road-bed to a depth of from 12 to 15 inches, and a width of 22 feet, with the large and regular stones built along either side as closely as possible to form a durable side wall for the gutters or side ditches, the interstices to be carefully filled in with broken stone and well rammed to the surface of the rest: upon this is to be placed broken stone, selected from the best of the region, to the depth of six or nine inches. This should be either well rammed or rolled. As erosion by water is the chief destroyer of all roads, the surface should have a slope of five to six inches from the center each way; the ditches should be three feet wide on each side, that

the water may be removed quickly and with as little erosion as possible. On long hills depressions should be cut across the road at every 50 yards to obviate the scour of the water through the whole extent of the hill. A sidewalk four feet wide, should be leveled up on one side at least with a slight pitch into the side ditch. Culverts should be introduced more frequently than is generally done in practice, and built larger. Steep hills should be avoided where the expense is slight in shifting the road-bed.

"*The Legal.*—No matter how perfect a plan there is devised to renovate the highways, unless laws are enacted to carry out such plans, it is only a loss of time. A bill should be framed to be passed by the legislature of each state, compelling the farmer to construct a given amount of road each year and to be credited on his tax list for the time and labor expended. Where a farmer owns a long stretch of main thoroughfare, special provision should be made for him; as, for instance, compelling his neighbors, whose work has been completed, to assist him, or the introduction of prison labor. Under such provision, the main roads of each state could be macadamized in three or four years in a manner that would last for a long term of years if repairs were rigidly kept up. Then attention should be turned to the rest of the highways till they were all completed; the annual repairs on any farmer's whole line would not consume any more time than the first year's work did. This law would not apply to incorporated towns or cites as their corporation councils construct good roads. A competent engineer, with a corps of assistants, should be appointed for each county of each state, and when the roads were once finished, the assistants could be dispensed with and the engineer, alone, could inspect the condition of the road in the future. He should see that the law was rigidly complied with in original construction and rewards might be offered to private citizens who might report any imperfection in construction.

"*Finally.*—In the Mississippi Valley the side ditches should be dug deeper and broader, and the slope of the road, from the center to the ditches, should be sharper to throw off the water as quickly as possible. In some regions the road-sides should be lined with trunks of trees to preserve the borders, the ends should be dovetailed, and stakes driven at the middle and ends of each tree. In wet, clayey districts, the roads should be corduroyed with the most durable timber available. These last two precautions I found were the only means of maintaining roads in the tropics where a clayey soil was constantly deluged with heavy rains."

MAUSOLEUM TO A RUSSIAN IN PERE LE CHAISE, PARIS

GRAPHIC NOTES FROM THE ANDES.

THE engineer who is making the surveys for an intercontinental railway in the Colombia, connecting the Pacific coast with a point in Venezula on the Atlantic, has written some very interesting letters on topography of that part lying between the two ranges of the Andes that incloses the highest plateau on the Western Continent. It is so nearly an unknown land that there is little or no information concerning it, and the descriptions of Mr. Shunk, the engineer, are both graphic and brilliant, and from them the following is excerpted:

"It may possibly enlarge or correct your notion of the country, as the first examination of it did my own, if I give you a brief description. This whole plateau valley, together with its outer slopes on Amazon and Pacific waters appears to have been built up co-ordinately with the gradual lift of the volcanic border peaks; and those volcanoes delivered, almost exclusively, mud and dust.

"The surface material, therefore, for an unknown depth, is mainly clay of some kind—white, yellow, brown and black. Seams of comminuted pumice occur, and beds of clayey conglomerate holding angular porphyry and trachite blocks, all sizes from a piece of chalk tc a house, stiffened in the argillaceous matrix to a half-rock, the consistency of hard pan; here and there strata of water-rolled gravel and shingle; very rarely and low down a streak of lava. Little out-cropping rock is visible, except the high-up ridges and crater rims, and all such rock is porphyritic. This viscid mud discharge came to a rest at a moderate inclination, and volcanic dust showered down on it for the most part crosswise of the valley before the prevailing easterly winds, thus raising or helping to raise the 'nudos' or nots which tie the cordillera parallels together and form the chief obstacles to a good railroad line. The original activlty of this earthen output was twelve or fifteen degrees at the top, where it abutted the steep crater-cone; hence it gradually flattened to about five degrees at the base. Before weather-wear began, assuming that to be supposable, the topography must have been not unlike the surface of a row of hippodrome tents, set end to end, thirty to fifty miles wide, and fifty to one hundred miles or upward long—where two touched a 'nudo'—the tuck-up poles baptized Chimborazo, Tungaragua, Cotocachi and so on.

"Erosion, however, has done marvelous sculpture on this symmetrical

world. It seems to have begun at the summits, where rain and snow began most vigorously. The tendency was to form an annular depression about each central cone—a ring pond overflowing at low spots. Hence, broad-based, smooth and cultivable triangles of the ancient surface surround every typical peak or crater, their points upward, like the cloven calyx of a rose against the bud, with abrupt counter-slopes, and divided by chasmal ravines, narrowing downward to canyons. Good drainage has preserved these significant surfaces, and plenty of it has scoured the canyon's deep, not only on the mountain flanks, but across the plains and down the outlet valleys to ocean or river. Along the lofty ridges between those old craters, dead and alive, the same tendency and effects are manifest, diversified, however, by occasional concentration of wash in the coves and immense landslides, either rewrought where they fell or dissolved and distributed over old lake bottoms, to reappear to us as plain country—the garden ground of the republic.

"Probably nowhere else in the world is there such a huge and illustrative example of millennial erosion. It is a paradise for both artist and scientist; and, we might add, for the valley haciendaros. The native Indians, who climb up by daylight to till their little shelves of green near the snow line, or scanty patches on steeps of 50 degrees, and climb down at sunset to potato soup and a nocturnal scratch, are not aware, belike, of the features paradisical.

"These mountains are grand but treeless; above the shrub limit pale green, with dashes of tawny; their shrubs of the myrtle kind on the lower declivities, chiefly in the caves and declivities; then the fat pastures of the plains, grain fields, gardens, clumps of fruit trees, and everywhere the eucalyptus as a feature in the landscape almost as characteristic as the adobe fences topped with cactus and maguey. It is remarkable that all surface material here seems to make adobe and stands. Even the compact black dust, now tempered to clay—very much like our 'bluff' along the Mississippi near Vicksburg and Natchez—at the vertical or slight deviations therefrom scales hard where exposed and greens over with a finely textured protective moss."

TO CLEAN CORUNDUM WHEELS.

TO clean corundum wheels, take one-third chloroform and two-thirds alcohol. The chloroform dissolvesthe waxand oil that accidentally gets on the stone; the alcohol removes the shellac and leaves the corundum free to cut as when the stone was new.—*Dr. Beacock, Dom. Dent. Jour.*

ASSOCIATION MEETINGS.

SECRETARY I. H. KELLEY, of the Ohio Marble and Granite Dealers' Association, and to dealers in general throughout the state, has issued the following circular, that we hope will be read by all workers in stone, and further, that each reader will consider himself especially invited. It is an old Scotch saying that "many mickles make a muckle." The problem is not so much to make a great aggregation, as it is to make each member realize that on him rests the burden of responsibility. A meeting is called. Each "mickle" considers that his absence will "make no difference." But then all the other mickles repeat the same thing, and the outcome of things is that all the "mickles" are absent and there is no "muckle." It is the same old allegory of the Missionary of Salisbury Plain and the bundle of sticks. Nothing less than a hydraulic press can break the bundle. A child can break each stick taking one at a time. But comparisons are odious, and should be unnecessary. Each should read the riddle, and each should seek counsel in the *E pluribus unum*. Following is the appeal of Secretary Kelley:

OFFICE OF THE MARBLE AND GRANITE DEALERS' ASSOCIATION OF OHIO
SPRINGFIELD, O., JUNE 1, 1892.

To the Members of the Marble and Granite Dealers' Association of Ohio, and Dealers in General Throughout the State.

GENTLEMEN: The time is near at hand for the next regular meeting of the Marble and Granite Dealers' Association of Ohio which will take place at Toledo, O., on Tuesday, July 12, 1892.

Headquarters will be at the Hotel Jefferson, where reasonable rates have been secured and good entertainment assured.

It is desired that this meeting shall be of special interest and profit to the entire trade; and as the legislation of the association is not for its members alone but for the general good of the trade, it is hoped that this invitation will be met with a hearty acceptance and result in a more general attendance of all dealers than ever before Our meetings are open to all and from the work in hand benefits may accrue that will interest every dealer in the state.

A special feature will be a report of the action of the National Association of Marble and Granite Dealers of the United States and Canada, which met in Quincy, Mass., on the 20th of April last. The relations existing between the wholesale and retail dealers, and the measures proposed to enhance the mutual interests of both will be discussed and acted upon.

The proposed districting of the state for local associations, the probability of its accomplishment and the good to be derived therefrom, together with the method for raising funds necessary to effect this purpose, and the individual liability of members for the assessment as ordered by the association will receive due attention.

The annual report of the Secretary and Treasurer will be presented, showing re-

ceipts and disbursements, and a general accounting of all members in relation to claims of the association upon them.

The terms of the present officers will expire July 1, and the selection of officers for the ensuing year should enlist the interest of every member of the association and result in a large attendance.

It is hoped that this appeal for your attendance will not be passed without due consideration.

All are equally interested and should aid in the endeavor to promote the general advancement of our calling. Already much good has been accomplished, and if the assistance of all dealers, especially members of the association, was freely given, we should soon see the beneficent result in the promotion of trade, and the advancement of social and financial interests. Respectfully,

I. H. KELLEY, Secretary.

P. S. The annual meeting of the Marble and Granite Dealers' Association of Indiana is called to meet on Thursday July 11, at Warsaw, Ind., which is but a short distance from Toledo, O. Ohio dealers and others are cordially invited to attend that meeting, and may be assured of a fraternal and cordial welcome.

The Indiana Marble and Granite Dealers' Association will hold its semi-annual convention at Fountain Park Hotel, Eagle Lake, near Warsaw, Ind., on Monday, July 11. It is desired that as many as can will arrive at the hotel on Saturday and Sunday, the 9th and 10th of July. A circular will be issued in due time by Secretary Ranck announcing the features, rates, etc. The Ohio association meets at Toledo on July 12, and it is expected a number of Ohio dealers will join their Indiana brethren at Eagle Lake, in a twin-state assemblage.

BAD HABITS IN BUILDING.

MR. EDWARD ATKINSON, in an article on slow-burning construction in the *Century Magazine*, recites the carelessness with which public buildings and others where masses of people are congregated are constructed. He says: "Strange to say, some of the worst examples of combustible architecture are to be found among our prison hospitals, asylums and alms-houses; next, among college buildings, libraries and school-houses; to these may be added churches, hotels and theatres. In the year 1887, according to the tables compiled by the *Chronicle* of New York, there were burned, within the limits of the United States, 45 hospitals, asylums, alms-houses or jails, being nearly four per month, in many cases accompanied by the loss of a large number of lives; 126 college buildings and libraries, being $10\frac{1}{2}$ per month; 146 churches, being $2\frac{8}{10}$ per week; 52 theatres and opera-houses, being 1 per week; 515 hotels, being $1\frac{4}{10}$ per day.

"The bad construction of these buildings is due mainly to habit, to fear of innovation, and to distrust of theory. These inherited faults in construction may readily be traced to their origin. In order to make this matter plain, the evolution of the modern factory will be fully described.

"When the textile factory system was first established, water power only was applied to the movement of machinery. The larger factories were thus customarily placed in narrow valleys, or upon very limited areas of land below the falls of rivers and alongside the streams; it therefore became necessary to economize the area of ground covered by the factories and to build them many stories in height. When other arts began to be conducted upon the factory system, the buildings were apt to be in cities or towns where the price of land forbade large areas being devoted to the purpose, and, again, buildings of many stories in height were constructed.

"As time went on, however, steam took the place of water power, while cheap railway service or rapid transit made it possible to scatter the factories over a wider area. Factory buildings then began to be constructed in the open country, but apparently it did not occur either to the owner, the managers, the architects, or the builders, that the reasons for constructing a building many stories in height did not apply to places where land could be had at a very low price; therefore the customary bad and unsuitable form of construction was adopted, and is still practiced, where it is not only useless and unsafe, but less adapted to the purpose to which the building is to

be put than a one-story or a two-story building would be. Moreover, the whole method of cutting timber having been developed with a view to the supply of material required in the ordinary unsafe and unsuitable method of construction, it was for many years difficult to obtain material cut in a proper way for what has been called the slow-burning use of timber. Hence it follows that the art of slow-burning construction is little known outside the limits of New England; and until very lately it was little known even there, except to those who had become accustomed to the construction of textile factories, paper mills and other works which are customarily insured by the factory mutual insurance companies. It is only within a very short time that the methods which have been practiced for many years in the construction of textile factories—which are only the old methods of almost prehistoric time, when timbers were shaped by the axe or by hand, before the modern saw-mill had rendered the construction of a sham building possible—have been taken up by a few architects of capacity and responsibility to be applied to warehouses, churches, college buildings, and occasionally to dwelling-houses."

ANCIENT RUINS IN AFRICA.

AT a recent meeting of the Royal Geographical Society, Mr. Theodore Bent read before a large audience a paper on his recent exploration among the Zimbabwe and other ruins. The paper, *Nature* says, was one of great interest. Mr. Bent said that, with his wife and Mr. Robert Swan, he went to Mashonaland primarily to examine the ruins of the Great Zimbabwe. These ruins, so named to distinguish them from the numerous minor Zimbabwes scattered over the country, were situated in south latitude 20° 16' 30" and east longitude 31° 10' 10", at an elevation of 3,300 feet above sea level, and formed the capital of a long series of such ruins stretching up the whole length of the west side of the Sabæ river. They covered a vast area of ground, and consisted of the large circular building on a gentle rise with a network of inferior buildings extending into the valley below, and the labyrinthine fortress on the hill about 400 feet above, naturally protected by huge granite bowlders, and a precipice running around a considerable portion of it. Mr. Bent gave a minute description of the ruins, drawing attention to evidence that their anciens inhabitants must have been given to the grosser forms of native worship. Perhaps the most interesting of their finds in one portion were those in connection with the manufacture of gold. Mr. Bent held that the ruins and the things in them were not in any way connected with any known African race, the objects of art and the

special cult were foreign to the country altogether, where the only recognized form of religion was, and had been since the days when the early Portuguese explorers penetrated into it and El Masoudi wrote, that of ancestor worship. It was also obvious that the ruins formed a garrison for the protection of a gold-producing race in remote antiquity. So we must look around for such a race outside the limits of Africa, and it was in Arabia that we found the object of our search. All ancient authorities speak of Arabian gold in terms of extravagant praise. Little, if any. gold came from Arabia itself; and here in Africa gold was produced in large quantities, both from alluvial and quartz, from the remotest ages. A cult practiced in Arabia in early times was also practiced here; hence, there was little room for doubt that the builders and workers of the Great Zimbabwe came from the Arabian peninsula. He had no hesitation in assigning this enterprise to Arabian origin, and to a pre-Mohammedan period.

THE ART STIMULUS OF THE WORLD'S FAIR.

IF the present indications are fulfilled, the exhibit of sculpture at the world's fair will be the most varied and extensive ever exhibited if we except the purely classic type afforded by centuries of accumulation in Europe. In the architectural sense especially the exhibition will be complete, and it is safe to assert that in its influence as an educator of the public, its effects will be marked and lasting. The masses of the American people suffer by isolation, and fail to appreciate proper forms because they are unfamiliar. But the occasion will draw many hundred thousands to Chicago, who will leave with well defined ideas and a wealth of comparision that will be felt in our architecture for years to come. In our buildings we have forgotten the sense of their ornamentation, except that instinct for ornament, that untrained is seen in *bizarre* effects and impossible combinations, that together form monstrosities. Most of the work will be in stone, the only piece of note in bronze will be the large fountain in front of the administration building, designed by Federick MacMounies, of Boston, and a pupil of St. Gaudens. The sculpture of the agricultural and the fine art buildings will be by Philip Martiny, of New York; the administration and the manufactures and liberal art buildings, by Carl Bitter, of New York, the transportation building, by John Boyle, of Chicago; the horticultural building, by Lorado Taft, of Chicago; the machinery building, by Robert Kraus, of Boston; the electricity building, by Carl Rohl Smith, of Louisville; and the modeling on the fisheries building, by Joseph Richter, of Chicago. The statue of "Columbia," which will overlook the lake at the water entrance to

the fair, is by Daniel Chester French, of Chicago. Of these sculptors the majority are American, that is, either born or educated in this country. Carl Bitter is the exception, having come to the United States two years ago. The work performed by these sculptors is excellent, and will advance the cause of art immeasurably, and in connection with the architectural combinations, advance the popular taste in building.

A MONUMENT TO COMMODORE PAUL JONES.

ONE of the most picturesque figures in American history is Commodore Paul Jones. The country that was so deeply indebted to him allowed him to die in poverty and neglect in Paris, and not even the tardy recognition of a commemorative monument stands to his honor. But at last there is probability that this tardy justice will be extended, and a bill has been introduced in Congress, for the erection of a fitting monument. Of all the revolutionary heroes, his career is the most romantic, and also the most mysterious.

From the date when he sailed away in the Providence his specialty was the distressing of the enemies or his country and her liberty. During a six weeks' cruise he captured sixteen prizes, although his sloop was armed only with four-pounders and he was constantly obliged to run the gauntlet of vessels of superior force. No American is ever too old to recall how his young blood moved quicker when he first read this wonderful story of skill and daring; how Jones took prizes in St. George's channel; how he landed at Whitehaven to burn the shipping and thus cut off Ireland's supply of coal; how he took his crew to the estate of the Earl of Selkirk on the River Dee for the purpose of kidnaping that noble personage and compelling the English to submit to a system of exchanging prisoners with the colonies, a project in which he was only thwarted by the absence of the earl; how, when his men robbed the house of silver plate, he purchased the plunder and returned it to Lady Selkirk, and how he whipped the Drake with his ill-armed Ranger and took possession of his prize against a crew numbering twice his own.

But the most thrilling chapter in his whole career is that which tells of the battle between the Serapis and the Bon Homme Richard. Who that has ever read it—and what American has not?—will ever forget that gallant fight; the two vessels lashed together like two giants in a death struggle, men driving their cutlasses at each other and firing pistols at such close range that their faces were burned by the powder, while the cannon of each vessel belched through the very portholes of its antagonist?

At the commencement of the action two of the old eighteen-pounders

which Jones had been at such pains to mount in the gun-room of the Richard burst, blowing up the deck above and killing or wounding a large number of the men. Then this part of the battery was abandoned and the ports were closed. An hour's close and heavy cannonade and the ships had fouled each other. With his own hands Jones assisted in lashing the jib stay of the Serapis to the mizzen-mast of the Richard, and the ships were in actual contact fore and aft. Locked in this deadly embrace two big bull-dogs tearing at each other's throats, shot and fire belched from porthole to porthole for nearly two hours longer, and then the Serapis struck her flag

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A STRANGE CASE.

AN interesting legal point in relation to cemetery titles was raised in a recent suit in Newark, N. J., involving titles to lands lying between Broad and Market street, partly inclosing an old cemetery.

It is of interest in a case involving old titles and ancient history as this does to notice that it is the act of 1848, said to have been drawn by the late Judge Bradley, which in Judge Depue's opinion, if valid, closes once and for all the controversy. That act validated the occupation of the property, even though for purposes different from the uses prescribed by the patent of 1696. The contention is made that the act is void, in that, in violation of the Federal Constitution, it seeks to impair the obligation of contracts. Upon this point, no doubt, the further contests will largely turn.

Judge Depue, in his opinion, holds the original patent vested no title in the municipality. Title first came to it by the act of 1804, which excluded from its operation the lands now in dispute. Apart from that act the right of the township, now the city, was only one of possession, essential to the protection and preservation of the premises and their use for the purposes to which they had been dedicated. The public use, he says, could be changed, modified or altogether set aside by the Legislature and its action could take away from township or city the right of possession. Holding these opinions he found in the act of 1848 adequate support for the title of the First Presbyterian Church and those who have received from it grants for the disputed lands.

A VERY HARD QUESTION.

THE latest strike in New York has a granite foundation; but it is said that the heart of the employers is stone.

THE PALACE CITADELS OF NINEVEH.

NEITHER the rude Scythian hosts nor the combined forces of the Medes and Babylonians (the latter of which peoples was well skilled in siege operations) made any impression on the strong defenses of Nineveh, which fell at last only before a mighty inundation of the river Tigris. But even when a besieging force had penetrated into the city it would have encountered other defenses of no small strength. The royal palaces were so constructed that they could be turned into citadels. They stood upon vast platforms, built of sun-dried bricks faced on all sides with solid stone, rising from sixty to eighty or more feet above the level of the plain. The platforms rose as high as the front of Charing Cross or Westminster Palace Hotels. [These are about 100 feet high.] They were built in rectangular oblongs along the side of the river, alike for the purpose of defence and for the cool air from the river, and the wide unobstructed view of the surrounding country which such a position afforded. To give roughly an idea of the extent of the larger of these palace-platforms we may say—draw a line from the Thames at the Victoria Tower of the Houses of Parliament to the Westminster Palace Hotel, from thence across the Horse Guards and Trafalgar Square to St. Martin's Church, and thence back to the Thames along the eastern front of the Charing Cross Hotel, and imagine that the whole of this vast area was occupied by a platform rising perpendicularly in one unbroken front to the height of seventy or eighty feet. Such were the larger platforms upon which the Assyrian palaces were built. [This area would be roughly described as a parallelogram inclosed by two sides each one half-a-mile long, and ends of one-fourth of a mile wide.—ED. STONE.] The palaces themselves appear to have been in the main, if not in all cases, one-story buildings. Having obtained the magnificence and convenience of height by means of the platforms, the Assyrian monarchs did not rear their palaces in stages, wisely preferring the luxury of a wide extent of courts and halls and minor apartments all upon the same level. Doubtless, as is usual in Eastern countries, they would frequently repair to the level roof of their palaces to enjoy more fully the open air and the wide view, which they could do, owing to the height of their palaces above the plain, free from the attacks of the gnats and mosquitoes to which their subjects were liable in the world below. Such vast platforms were usually the work of two or more sovereigns, each adding to the platform of his predecessors when he wished to erect a new palace for himself. Thus Asshur-i-danipal built a palace for himself on the level of the same platform upon which his grandfather, the mighty Sennacherib, had built his. In fact, during the later and more

flourishing period of the Assyrian Empire each monarch built a palace for himself, and Esarhedon built no less than three. The palace never occupied the whole of the summit of the platform, one-half of the level summit being usually laid out in open paved courts, sometimes with a ziggurut or temple-tower occupying one corner of it. Nevertheless, as may be inferred from the vast size of the platforms, the palaces were of great extent, embracing large halls of state, wide open courts and a vast number of lesser and chiefly private apartments. All the chief entrances or doorways of the palace were adorned on either side by colossal winged bulls or lions with the head of a man sculptured in fine limestone, and the chief halls and apartments were lined to the height of nine or ten feet with slabs of the same material, on which were represented in color the exploits of the king who built the palace with descriptions detailing the events of his reign. And above these sculptured and colored bas-reliefs the walls were faced with enameled bricks all the way up to the roof of the halls, which were usually from seventeen to twenty feet in height. Beneath these lofty palatial mounds lay the common buildings of the city, which, if we may judge from the representation of an Assyrian town on a recovered bas-relief, were dome-shaped in the roof and lighted not from the sides but from the top, as the palaces also were in the main.—*The Architect.*

A GREAT TABLELAND 17,000 FEET HIGH.

CAPTAIN BOWER, of the Indian Staff Corps, has arrived at Simia from China, after a very remarkable journey across the Tibet tableland. He had with him, says *Nature*, Dr. Thorold, a sub-surveyor, one Pathan orderly, a Hindostani cook, six caravan drivers, and forty-seven ponies and mules. The Calcutta correspondent of the *Times*, who gives an account of the journey, says that Captain Bower, leaving Leh on June 14, crossed the Lanakma Pass on July 3, avoiding the Tibetan outpost placed further south. Journeying due east, he passed a chain of salt lakes, one of which, called Hor-Ba-Too, is probably the highest lake in the world, being 17,930 feet above the sea. Gradually working to the southeast, the explorer saw to the north a magnificent snowy range, with a lofty peak in longitude 83° and latitude 35°. After many weeks' travel over uplands exceeding 15,000 feet in height, where water was scarce and ho inhabitants were to be seen, the party on September 3 reached Gya-Kin-Linchin, on the northern shore of Tengri Nor Lake, in longitude 91° and latitude 31°. This is within a few marches of Lhassa, and two officials from the Devi Jong, or temporal governor of Lhassa, met him here and peremptorily or-

dered him to go back. But he refused to return, and a compromise was effected, guides and ponies being provided on his agreeing to make a detour to the north in order to reach the frontier of Western China. He reached Chiamdo on December 31, only just succeeding in getting off the tableland before winter set in. He struck Bonvalot's route for a few miles when marching to Chiamdo. The country about this town is very fertile and wooded. Three thousand of the monks of Chiamdo, who lived in fine monasteries, threatened to attack the party, but were deterred on learning that they carried breechloaders. Captain Bower arrived at Tarchindo, an outpost on the Chinese frontier, on February 10. The distance covered from Lanakma to Tarchindo was over 2,000 miles, all of which, save a few miles, has now been explored for the first time. The route for thirteen consecutive days lay over a tableland 17,000 feet high. Captain Bower is engaged in writing a report and completing his maps.

A COMPARISON FOR STONE-CUTTERS.

A MASTER of the Spanish school of painting being asked how he mixed his colors, replied: "With brains." Every worker in stone should try to add something from out of himself in his work. His fancy, if uncultured, may lead into the grotesque, but the grotesque is preferable to the stiffness and deadness of much of our monumental art. A touch of the fancy of the mind is needed. It is the spark of vitality that gives life to its object. In a general sense this could be no better illustrated than by the following from the *Architect* in reference to the schools of Egypt and Greece, which every stone-cutter and every observer has felt as he looked upon the magnificent chilliness of the Egyptian, and compared it with the vital warmth of the Greek: "Colossal magnificence seemed the object of the Egyptian artists; that of the Greeks was simplicity, beauty, grace and sublimity. The African sculptor desired to astonish, the European wished to delight. The former wrought by mechanical rules, and produced his figures by a formal process, in which the hand had more to do than the mind; the latter called in poetry to his aid, and all but endowed his works with motion and speech. Nor did all this difference arise from more dexterous or more delicate workmanship; it lay as much or more in the original design" and still more in the hand that wrought it out.

THE 150-FOOT BUILDING LIMIT.

IT seems there will be a limit to high buildings in Chicago. The danger in it was a spirit of emulation that led to abnormal heights purely through a desire each builder had to surpass all preceding records. Henceforth no building is to exceed 150 feet in height. Where the width of a street is not more than 80 feet the extreme height is 125 feet, and if the width is not more than 40 feet the height is to be 100 feet. In any case where a building is erected with frontage upon two or more streets of different widths, the height is not to exceed the average of the maximun heights which are permitted for buildings erected upon streets of the width of those upon or abutting on which the building is to be erected. For instance, where a building is to be erected having frontages upon two streets the widths of which are respecively 40 feet and 80 feet, the height is not to exceed 112½ feet. When a building is set back, in whole or in part, from the street line, in such manner as to increase the width of the street in front not less than one-third of the height of the building, an increase in height will be permitted directly in proportion to the aggregate increase so made in the width of the street; but in no case is the height to be so increased as to exceed 150 feet. The regulations are to be taken to forbid or prevent the erection to a greater height of spires, towers, domes or cupolas, the area of which shall not be more than 15 per cent. of the ground area of the proposed building. The regulations do not apply to buildings constructed under building permits already issued, provided that the actual work in the construction of such buildings shall be commenced within six months from and after the date of such permits. All permits already granted for the construction of buildings exceeding the above heights are to become of no effect upon the expiration of six months from the dates upon them.

WE LIVE IN HAPPY TIMES.

ARCHITECTS and contractors will appreciate the "humor" contained in the following, which, while more especially true of England, will live in America as a part of the gloomy recollections of those who have passed a few years in pursuit of their favorite calling. It is from a correspondent of the Nottingham *Daily Guardian*: "I have been having a chat with a friend of mine who has the misfortune to be an architect, and who poured forth his grievances. We are, he declares, over-legislated in these days. What with county councils and local boards and other meddlesome authori-

ties, an architect has need to be a lawyer to keep out of difficulties. Each body makes its by-laws, which it enforces totally regardless of consistency and common-sense, to say nothing of the claims of art. My friend had to carry out some restorative work in a fine old country house, three or four hundred years old, with ancient wooden gables. The local authority steps in with the by-laws intended for a modern street, and insists upon the use of brickwork! Then in another instance a law insisting on twenty-five feet behind a building interfers with the order of work. Nor do these wise people agree together. A householder ordered by the santiary inspector to make certain alterations finds them condemned by the next official!"

RIGHTS OF THE LOWEST BIDDER.

THE practice of reopening bids, no matter upon what grounds, is pernicious, and also is so suggestive of dark-lantern methods, that, after a fair competition has been fairly won; and afterward, should it seem necessary to so change the conditions that new, or least additional, estimates are necessary, it is a height of injustice to refer the whole back to a new competition. It is a fair presumption that the skill or conditions that would enable a contractor to win a case, should inhere to him if the conditions were to be changed. It costs much money to even make a bid on a large job, with the ever present risk of losing the work by failure to win the contract. But, after all this, to expect a bidder to repeat the expenses and double the risk is a positive injustice. Says the *Inland Architect:*

"It is only by unrelenting insistence that the builder can secure what are justly his rights. Customs which are inequitable and unjust have been permitted to spring into existence and have become firmly established. Architects are in the habit of requiring very one-sided conditions of competition and agreement, and it is only by insisting upon his rights that they can be obtained by the builder. The architect is protected in his position by the idea which seems to exist very generally in all communities, that if one builder will not comply with his requirements, there are plenty of others who will. A case has recently transpired wherein the lowest bidders on a building to be erected by the state refused to refigure the job with other contractors, demanding the contract and the right to re-estimate without competition, on the basis of the principles advocated by the National association of builders. The contractor firmly maintained his position, claiming that he was entitled to the contract and that a proposition to refigure in order to secure certain reductions in the cost without material change in the plans should be presented to him only. The state authorities, seeing

the justice of the position taken by the National association, in addition to the fact that the contractor would not yield his rights in the case, conceded the point and awarded him the contract without further competition. The final yielding by the state of the position which it maintained established the fact that the same was unjust and untenable, but had the contractor been a person of less persistence the competition would have been reopened upon the unjustly acquired information as to amount below which bids must have been submitted. The correction of such conditions remains solely with the builder, and he is to be blamed for not declaring his rights before a competition and insisting upon obtaining them afterward.

A WESTERN "HELL GATE."

THE improvement of the Tennessee river at Suck Point, involved the removal of a mass of rock from the river channel, in a minor sense akin to the removal of the Hell Gate obstruction in East River, New York. The great blast was engineered by Col. Sublett, and was made to destroy an enormous mass of rock, that contained 1,800 yards, and stood 25 feet above low water mark. Twenty-one holes one and one-half inches in diameter were drilled ten feet deep, and these were collectively charged with 190 pounds of dynamite of 60 per cent. nitro-glycerine strength. The explosion was ignited by the usual electrical battery. When the key was touched the immense body of rock seemed for an instant to rise into the air without a sound, and then followed a report whose reverberation shook the adjacent hills. The blast was highly satisfactory, nothing remaining of the obstruction but a mass of broken stone. The result is the width of the channel is increased 100 feet, at a point 7 feet above low water mark. It will occupy several days' time to remove the debris, which is to be dumped into the big eddy. Col. Sublett says there are several more bowlders to be removed, and upon the next occasion instantaneous photography will be brought into play. The removal of this rock will greatly increase the discharge of water at high stages.

AN UNSUITABLE QUARRY.

THE *Brick and Tile Journal* gives an account of a peculiar lawsuit, that will be read with interest by quarrymen and contractors, especially of the class that let out quarries to contractors for their especial use for limited times. The action was tried at the Glamorganshire assizes on April 12,

1892, in which plaintiffs claimed £2711 damages, whereas defendants made a counterclaim of £3891. 7s. 9½d. The plaintiffs, who were builders and contractors at Preston, entered into a contract with Isaac George and others (who represented a building society at Mountain Ash) for the purpose of building eighty-one houses by contract. One of the terms of the agreement was that the contractor should quarry the stone required free of royalty from a quarry near the site. On April 23, the plaintiffs commenced work. After the contract had been signed, the plaintiffs wrote to the defendants to point out the quarry as per agreement. The latter subsequently pointed out a little gully, from whence it had been absolutely proved they could only get rubble stone, unsuitable for building purposes, and that even this stone could only be got at the exorbitant price of 6s. per cubic yard. The plaintiffs had been put to extra expense in opening the quarry. The plaintiffs had repeatedly asked to be put on to another quarry, and also for compensation, without result, and they had consequently discontinued the work, and now brought their action for damages. His Lordship, in delivering judgment, said that there was not such a failure on defendants' part to carry out stipulations as to justify the other side in rescinding their part of the contract. It seemed to him that it was a matter which the parties should come to an arrangement about. After a long consultation, the cause was withdraw by consent, the Judge giving an order for £25., if necessary, which the defendants undertook to pay.

THE GREATEST OF PALACES.

THE Vatican, the ancient palace of the popes of Rome, is the most magnificent building of the kind in the world. It stands on the right bank of the Tiber, on a hill called the Vaticanus, because the Latins formerly worshiped Vaticinium, an ancient oracular deity, at that place. Exactly when the building was commenced, no one knows. Charlemange is known to have inhabited it over 1,000 years ago. The present extent of the building is enormous, the number of rooms, at the lowest computation, being 4,422. Its treasures of marble statues, ancient gems, paintings, books, manuscripts, etc., are to be compared only with those in the British museum. The length of the statue museum alone is a fraction over a mile. Conservative writers say that the gold contained in the medals, vessels, chains and other objects preserved in the vatican would make more gold coins than the whole of the present European circulation. This, however, is evidently a mistake, and expressed more to make the great wealth of the collection evident to the mind than as an exact fact.

FISHES OF OTHER AGES.

A COLLECTION of the oldest fishes of the world is now being prepared for exhibition at the National Museum, Washington. They were dug out of the rocks recently at Canyon City, Col. Great scientific interest has been aroused by the discovery, because they are at least 100,000 years more ancient than any creatures with backbones ever found before. They come from the sedimentary deposits laid down by the water in the distant epoch called Silurian. No vertebrate animals had been obtained previously below the upper silurian. These are from the lower Silurian, and some notion of the difference of time may be got from the fact that the two "horizons" are separated in the Appalachian region by 20,000 feet of sediment. Where these fishes were found was once a sand beach on the western shore of a vast interior sea, which extended eastward from the Rocky Mountains and covered a large part of the continent.

Geologists wandering through that region, so prolific of treasures in the shape of fossils, came upon the deposits accidentally. The line of the ancient beach is still visible, although it is overlaid by sedimentary rocks of subsequent formation. They made excavations with pick-ax and blast, getting out a great quantity of material, which was brought to Washington. Thirty millions of years have perhaps elapsed since the creatures thus dug out were living. It must have been a strange world in which they had their being so far back in the night of time. Even the reptiles which flourished and attained such gigantic dimensions at a later period did not yet exist. The only vertebrates were fishes.

These fishes of the lower Silurian were all small—the diminutive types of the great fishes which swarmed in the waters during a later period, which has been called the age of fishes. They were clad in armor, being covered with plates of bone instead of scales. Their skeletons were composed wholly of cartilage, like those of the sharks of to-day, which themselves represent an enormously ancient finny pattern. Under the microscope it is possible to see the structure of the bone which composed the plates. In similar armor was the huge and ferocious dinichthys, as well as other marine monsters of a subsequent epoch, dressed.

Besides the fishes many invertebrate animals were found in the same deposits. There were innumerable boring worms, and it is very interesting to see the actual holes which they made so long ago in fragments of the rock. There were trilobites also—queer crustaceans which were the ancestors of modern lobsters and crabs. Mollusks were there in plenty, too, of a species known as the "lingula," somewhat resembling clams. Millions upon

millions of years ago they were good to eat. At the present time the lingulas are very plentiful in Chesapeake Bay. Of these ancient creatures they alone have survived; the others are still extinct. Together with the fossils above described were discovered ever so many specimens of the orthoceras, a mollusk resembling the chambered nautilus, but having a straight shell instead of a spiral one. Above the deposits which formed the grave of the animals mentioned a coral reef subsequently was built by industrious polyps.

AFRICAN MONUMENTS.

TWO interesting ancient stone monuments have recently been carried to Lisbon from the west coast of Africa. They are hewn out of solid blocks and are similar in size and shape. The lower part consists of a round pedestal five feet high by ten inches in diameter; the upper part being an oblong block eighteen inches high by twelve inches each face. The inscriptions on one are in a perfect state of preservation, but those on the other are entirely obliterated. These monuments were erected on the west coast of Africa by the Portuguese navigator, Diogo Cao, when he discovered the country in the fifteenth century. The inscriptions are in Portuguese and in Gothic characters. They prove that the discovery of the Congo and that part of the coast south of the equator was in 1482, or some years earlier than has been long believed.

THE OLDEST AMERICAN MONUMENT.

BALTIMORE has discovered a neglected memorial shaft to Columbus "in its midst." It is true that, like the stone bearing the mysterious inscription which Mr. Pickwick found in the course of his rambles in Surrey and exhibited to his fellow-antiquarians, there is another version of the Columbus story. The shaft referred to stands on the grounds of the Samuel Ready Asylum. A commentator says of it: "The site of the asylum was once the property of an eccentric Frenchman, who erected within sight of his window a monumental shaft to the memory of 'Chris. Columbus.' It is believed by many persons that the old gentleman built the monument in honor of the discoverer of America, but there are others who say it was erected to the glory of a favorite horse." Mr. W. H. Jenkins, a venerable citizen, asserts, however, the genuineness of the Columbian relic. This is his statement: 'In the year 1784, during the short stay—or rather encampment—of the French troops from Yorktown, Va., this shaft

or monument was erected, and October 12 of the same year was dedicated to Christopher Columbus by the French Consul-General, Count d'Amour. He, with some hundred or more of the French officers and men of Gen. La Vallette's corps, was present, and remained afterwards in Baltimore. Some of them were well-known citizens as late as 1835." The Count, it seems, sold the estate, and it passed eventually into the hands of Mr. Zenus Barnum. Mr. Jenkins thus explains why the shaft has been overlooked in recent years: "When this monument was erected the Hartford road was not in existence, but there was a public highway east of the present one, known then as 'Taylor's New Cut' road, and later as Brown's lane. When the Hartford road was finished as far as the Gunpowder river, Brown's lane was closed north of the monument. This is the secret as to why the Columbus monument was so long obscured from public view in every direction. This new thoroughfare necessitated a change of front and placed both the cottage and the Columbus shaft altogether out of sight from the new road, as the dense woodland hid everything from that direction. For over half a century or more, and on until the late Civil War commenced, Christopher Columbus and the monument had no place in the minds of the people in the neighborhood, nor indeed anywhere in Baltimore. Unquestionably this shaft is the first ever erected on this continent to Christopher Columbus, and is, therefore, the father of monuments, and is worth preserving."

USES OF BURNT-CLAY MORTAR IN ITALY.

THE United States Consul at Catania, in his last report, says that visitors to Catania invariably notice and remark on the peculiar soft pink color of all the unpainted buildings. This coloring is the result of using cement or mortar of proved value, found in the vicinity, and which is nothing more nor less than burnt clay. In the frequent eruptions of Mount Etna in times past great beds of clay were covered and buried from 20 to 200 feet by the lava streams, with the result, when the eruption happened in the dry season, of burning and converting these clay beds into a fine red gravel or powder. These deposits are mined, and are considered very valuable. The material, mixed with a little lime and the usual amount of water, forms a mortar or cement considered superior to any other cement for building purposes, and has been used in Catania to the exclusion of all other materials for centuries. Every building in Catania is constructed of lava liberally cemented with this mortar. In building, small irregular stones are used, just as they happen to come, and a smooth surface is after-

ward given by a thin coating of mortar, inside and out, which can then be divided by a trowel to imitate blocks of stone, if desired. This burnt clay, with lime, makes a very strong and adhesive mortar; no other material would hold together the large four and six-story apartment houses, which are built entirely of small irregular stones. It also has unequaled wearing and resisting power, as the extensive harbor breakwater proves. This breakwater was built some ten years ago, and extends for three-quarters of a mile out into the sea, and is said to be as good to-day as when first built. It is composed entirely of lava, and for a foot below water-mark to a sufficient height to protect the shipping, of huge blocks of small lava rubble liberally cemented with the mortar. The constant wear and tear of the sea for ten years has only damaged the cement in insignificant places, and probably only where there happened to be an air-space between the mortar and stones caused by faulty construction of the blocks. Consul Heath adds that the more he looks into the matter the more he is convinced of the value of this mortar as an economic substitute for all the high-priced hydraulic cements now used, and that it might well be adopted in other countries besides Italy.

A MONSTER CRANE.

THE Titan crane, built for the harbor of refuge works, at Peterhead, was tested recently. A load made up to 62½ tons was lifted and slewed round a circle from the center of a cantilever. It was then run to the extreme end (110 feet from the center), and the monster crane made another revolution—that is, it lifted this great weight and swung it round the circumference of a circle 220 feet in diameter. The deflection was no more than was expected, and the test was satisfactory. The Titan is constructed for 50-ton blocks, but none of the masses of concrete made will exceed 45 tons.

THE ELKS' REST.

THE Detroit Lodge of the Order of Elks will erect a memorial at Woodmere Cemetery that for purity of sentiment and art in design marks a radical departure from the stiff and meaningless sculpture that has been the nightmare of necrological art. We have not gone far from the eyrie tablet of the last century, with its skull and cross-bones and its grotesque epitaph to the fence-post obelisk, with its conventional sheep or urn, and it is doubtful if even this progress has not robbed the old memorial of its few

touches of pathos and human nature that move through the old with all of its grotesque and at times horrible fancy. Anyway there was a fancy of some kind, while now we have form without a trace of it. We do not mean to assert that this is the first departure from the formulæ, but that amid the efforts to break away from conventionality, this departure is noteworthy for its completeness, as a picture of pure nature that for that reason is profoundly emblematic in its expression. The base of the monument is of irregular slabs of granite that look as if nature had piled or left them thus, much as one sees gigantic bowlders left behind by some ancient glacier. This is surmounted by a bronze figure of an elk ten feet high. On the base in runic characters is cut the only inscription, "The Elk's Rest," the whole making an ensemble complete in simplicity and full in suggestiveness. The bronze was cast by Bureau Brothers, of Philadelphia, who made the Bagley bust on the Campus Martius.

CURIOUSLY MARKED STONES.

THE famous Oberammergau stone, which has a human face full of sorrow, pictured by the hand of nature on its surface, has been characterized as one of the most curious freaks of nature that has been found. Pliny, about the beginning of the Christian era, mentioned an agate, the lines and markings of which formed a perfect picture of Apollo and the Muses.

Majolus, another writer of high standing, saw an agate in the collection of a jeweler in Venice that showed a perfect picture of a shepherd with crook in hand and a cloak thrown over his shoulders. The owner of this stone prizes it highly, and has refused large sums of money for it. In the church of St. John, Pisa, Italy, there is a stone marked with red, blue and yellow, the lines representing an old man with heavy beard with a bell in his hand, seated beside a small stream. To the faithful it is known as the St. Anthony stone, because it is a fair likeness of that saint, even in the minor details of tunic and bell. The "one-legged John," another stone picture, is in the mosque of Santa Sofia, in Constantinople. The picture is on a marble slab, and was found by quarrymen in Italy. It is perfect in every detail, except that the saint has but one leg and foot. A piece of ballast picked up by the Spanish consul in Boston, Mass., showed two perfect human heads and faces, the hair and features being distinct, the natural portraits being much darker than the surrounding stone.

EDITORIAL COMMENT.

THE strike, or lockout, in the granite industry, principally located in the New England states, has reached a magnitude that places it among the memorable strikes of the world. We, at this distance, who are without the pale of the influences that actuate the two parties in contact, can hardly realize why so small a difference should result in so great a war. Logically, no war should have occurred, because, logically, there was no reason for it. But the war has opened, nevertheless, and hence, pursuing the logical instinct, we must seek its cause or causes. Here again your logician is driven to the wall, so to say; except he assumes that the cause was due to a mutual lack of confidence.

THE New York *Sun* has in a sense truly described the contest as "The Tug Between Two Trusts." In a way, at least, the expression is true. A trades union is a thing organized for a purpose to conserve the values and life conditions of its members. In the case of the granite cutters' union, or, as the *Sun* would have it "The Granite Cutters' Trust," its purpose is that they shall not be injured by undue competition. In the case of the Granite Dealers' Association it is equally its purpose to ignore or destroy worthless and destructive competition. Both trusts, then are, or at least should be, organized for the single purpose to make a day's wages, and a cubic foot of stone have a stable, and profitable exponent. But—

IT would seem from the complexion of events that the society organized to maintain the status of a day's wages, and the society organized to maintain the status of value in a cubic foot of stone, had agreed to disagree, and that the trust organized to defend the status of a day's wages, that in its turn depends upon the status of value of a cubic foot of stone, flies at the throats of the men who have combined to hold up the status of the cubic foot of stone upon which the real status of the day's wages depends. Just why this is so it would be difficult to define by any logical method of reasoning.

BUT logical reasoning is not at stake in the controversy. It is either the false pride that would rather be wrong than beaten, or else it is that mutual distrust that cannot concede to the other party that honesty of purpose each claims for itself. The gravamen of the controversy seems to be in a settlement of a date for

the signing of contracts for the year. The employers' association claims, and in our opinion, with reason, that the necessity of business requires that they should know, on January 1, the wages scale, with its incident effect on costs, for the current building season—so that contracts, now on small margin, may be undertaken with the certainty that the wages scale may not operate meantime as a disturbing agent, through which the low profits may not be changed into losses. Therefore, the claim of employers that on Jan. 1, they should clearly know what the costs of operating will be, before they close their contracts for the ensuing season, is entirely reasonable and business like, and conservative to the interest of capital and labor alike.

In rebuttal, the unions claim that they are willing to formulate, on Feb. 1, the demands they would make on May 1. The employers wrote a statement on Oct. 1, of the demands that would be made from them for Jan 1. So the contest is removed in fact from May and January to February and October. The real question, looking to the good of the whole trade, only requires that contracts, to be filled during the subsequent season, shall have their bases settled at the beginning. If Jan. 1 is a date sufficiently early to admit this it is strange that so slight a difference could not be settled without an expensive and suicidal war.

In the West the stone-cutters, contractors and others interested have reached the system of January settlements, and a great cause of friction and injustice has been removed. There is no evidence that the unions have weakened themselves in the least by this concession. The strike among the granite-cutters seems to be due more to a belief that their employers are insincere, and that they are only seeking a January settlement in order to place themselves in position to undermine and disintegrate the unions during the dull months of the winter. On the other hand, the employers believe that the unions only refuse to consider a January settlement because on May 1, when business is brisk, they may better control the conditions they would inaugurate on May 1.

This brings the case to the point where its genesis is purely done to want of confidence. We can see no earthly reason for such a feeling. Both sides are strong enough for self-protection, and faithlessness would fail of its point. If the employers actually contemplated an arrangement in January that they deliberately intended to destroy, the fact would not alter any of the conditions the unions now have in May. And if the employers were to accept a settlement in May under stress of force, there is nothing to hinder them from abrogating it in January, when the unions claim they have all the advantage. The alteration of dates does not alter the condition of force on either side, and views to the contrary are purely imaginary.

So far as the granite industry is affected by the monument trade, any date of settlement would be a matter of indifference. But with the building and paving trades it is very different. All such are predetermined, planned, and the raw material contracted for early in the year, and by the first of May such material is largely on the ground and being put in place by the building mechanics. The necessity for a quarryman and contractor to know in advance what the costs of his summer operations is to be before he closes his future contracts, is essential to the stability of his business, and equally

so to the men whose wages are based on the prosperity and stability of the same business.

THE Philadelphia *Times* thus very strikingly puts the suicidal effect of the war: "Nor is the loss to the New England granite industry likely to be confined to Philadelphia, where two of our most prominent edifices, the Reading Terminal and the Betz building, will be compelled to change the material by eliminating New England granite. It will also affect many of the most imposing structures in New York and other cities, and the industry that will thus be sacrificed will be lost forever, as other building materials will necessarily take the place of the granite contracted for." It is not possible to estimate the indirect and permanent losses that will follow a prolonged quarrel, nor why the unions should not accept a date elsewhere conceded, by both sides, to be the best for the activity and prosperity of the whole industry.

HOWEVER this strike, or lockout, may end, it is clear unless justice is conceded that peace will be only an armed truce. Whether men or employers be driven to accept the views of the other, the beaten party will remain unsatisfied, and a sullen acquiescence take the place of the mutual confidence and respect that ought to exist. The men should accept January 1 as the time for formulating their schedule for the ensuing year, and the employers should remember that if their men mean to abrogate their contracts in May, that they will do it just as quickly whether the acceptance be given in October or January. January 1 is a good place to meet on, and it would seem as if so slight a difference should not be allowed to operate the destruction the present status is causing. The men seem to see in the employers' association only a machine organized purposely to break down the unions, and there is where the animus of their want of confidence lays. They should borrow counsel from their own experience, and know that the disasters of unregulated competition in stone material has been quite as severe as the competition among laborers has been. There are too many applicants for the same job, whether it be to furnish stone for a state house, or for a situation at the banker. Both parties should forever give up any idea to destroy the organization of the other, and both unite for the amelioration of evils that will require their united strength.

To change this very dolorous subject: It is not generally known that Thomas Jefferson was an enthusiastic student of architecture. The buildings of the University of Virginia at Charlottesville and the houses at Monticello are monuments of his skill and originality. The drawings for the university buildings were from Jefferson's own hand, and are accompanied by copious notes in the most minute and careful handwriting, giving the proportions of every part, with exact calculations of the number of brick and other material in each building. The main building was modeled from the Pantheon at Rome. The professors' houses are of different designs, mostly modeled after Palladio, and intended to exhibit the different orders of classic architecture. For many years his residence at Monticello was the standard American style, and was widely copied.

THE extent that marble, onyx and other stones susceptible of high polish is used in the interior decoration of buildings is striking proof of the general increase of the country's prosperity and culture. Their relative cheapness is also evidence

of the perfection of mechanical detail that admits their production in competition with the hard woods that were in universal use a few years ago. This cheapness, except possibly in the case of marble, is not positive in relation to first cost, but when considered in relation to the wear, cost of repair, and other items contingent on the use of wood, stone is the cheaper material, to say nothing of the superior artistic effects that the great variety and lustrous finish imparts. A million dollars of it is being used yearly in several of our large cities alone, and while the quarries of the world are drawn upon the practice is developing an enormous industry in stones capable of mosaic effects in all parts of the United States.

DURING many years congress has made an annual appropriation for headstones for soldiers' graves, one-half of which have the single word "Unknown" cut on them. How many more of these there be whose bones lie in the pits dug after battle for the interment of the dead, and those who lay in the scattered places in the wilderness wherein so many battles of the civil war were fought will ever be "unknown." That there are 150,000 soldiers' graves in various cemeteries marked "unknown" brings to the imagination as nothing else will, the prodigious scale and manifold horrors of the civil war, and this word "unknown" will wake up many slumbering memories in those, who, either in the field, or at home, were participators in those stirring events. Full many an aged or middle-aged woman is still seeking among the nameless headstones for some "unknown" who lives yet in the aching heart that still is seeking its long lost, and sees in such "unknown" the heart that personifies its own longings.

JUSTICE CLARK, of North Carolina, in a recent issue of the *Arena*, has a paper setting forth the reasons why government must augment the postal and telegraph systems, and in it considers the duty of the government to uphold the rights and liberties of the people against "monopolies," and believes that the people cannot urge congressional action any too soon. This may all be true, but it is not evident how the people are going to empower the government to destroy monopoly, without usurping the functions of monopoly and becoming itself the sole monopolist. In the face of a widespread and instinctive effort by farmers to monopolize the agricultural industry as seen in the alliance movement, and the almost complete monopoly secured by the artizan and laboring classes, and a general tendency of employers and capitalists to concentrate into some kind of organization, and all for a purpose to fortify their liberties and individual rights, it is difficult to see what government can do, except to accelerate the movement, and by usurping them become the complete monopolist. Individual rights are things measured by individual responsibilities, rather than by the abstraction universally current until lately that each individual has the right "to manage his business in his own way." Jefferson defined the "right" to mean that one may do as he pleases so long as he does not injure some one else. But measured by this standard the individual would have little privilege left. A band of workmen may decide to strike and a band of employers may decide upon a "lockout;" both injure others than themselves, and the obstinacy of both may result in injury to a large public who in no way are directly interested. It would seem as if the question of individual rights were already in the care of respective organ-

izations, made for a purpose to protect the individual. Perhaps the duty of government in such a condition will be to define the rights of these large aggregations relative to each other, and to the general public, in some cases, perhaps, to actually monopolize some lines of business, as for instance, as a large minority of the public are now agitating, to absorb the railroads, telegraph and some other semi-public enterprises now controlled by individuals. Whether for good or evil, the days of "individualism" are gone. The law of self-preservation seems to be making obsolete that old one based upon supply and demand.

THE warring granite industry might emulate the example of Toledo, where the workingmen, as elsewhere, who have generally been far ahead of the employers in appreciating the value of organization, have expressed themselves as decidedly in favor of organization on the part of the employers, on the ground that by this means united action can be secured which will control all workmen and all employers, or such proportion of each as shall be sufficient to bring about mutually satisfactory conditions through preponderence of influence and numbers. A more general feeling of this sort was expressed at the St. Louis meeting of contractors and quarrymen of the Ohio valley. There is a general tendency in this line that is bound to bear fruit in the near future, simply because this continued striking and locking out is mutually destructive. Perhaps these wars serve the useful purpose of teaching both how essentially necessary each is to the other, and the folly of their antagonism. It is quite an inspiring sight to the political philosopher to witness two suits for conspiracy—one by the union against an employers' association, and one by the association against the union, especially as a strict application of legal ethics would show that the existence of both organizations is positively illegal. If Uncle Sam were to place both under heavy bonds to keep the peace they might see the matter differently.

SINCE Decoration Day it has been announced that the entire fund for the memorial monuments to General Grant has been subscribed. The indifference of the Knickerbocker element of New York City in a matter that they seemed to want to take unto themselves, has been a plague spot to the patriotic impulse of the American people. It has been said that republics (or democracies) are ungrateful, but the results of this quest have shown otherwise. While dependence was placed upon the millionaire element of New York, the subscription languished, but when, under the new management of General Horace Porter, the appeals were made to the people—the populace—they were responded to and the money was easily raised. We owe classic art to the Athenian democracy, and the Renaissance to the trade guilds of Florence and Genoa. We owe the exuberance of Gothic architecture to Peter's pence, and the American commonwealth to the farmers of New England and the Middle States. *Vox populi, vox dei*, was otherwise rendered, almost at the same time that the parable of the widow's mite was told, and upper tendom in New York has shown that nothing has changed since. New York has come in for a share of criticism that the result has shown was undeserved, and was true only when applied to her plutocracy. The people, when they were given opportunity, did what the people will do everywhere, or else the thing will not be done.

THERE will be a meeting of granite and marble dealers of Indiana, at War-

saw, on July 11. Warsaw is one of the best summer resorts in Indiana, and the middle of July should inspire every dealer in Indiana to take an outing for a few days—say, be in Warsaw Saturday and Sunday, get acquainted and talk matters over in an informal way, and be ready on Monday morning for the regular meeting. It would then be well to arrange so that the members would go to Toledo, and help to swell the number from Ohio, as well as to extend the friendly relations of the two states. Too much attention to purely business details has a tendency to isolate and narrow one, and that one is likely to forget, in contemplating his own petty troubles, that they are largely due to that very isolation. In this day business has no longer a mere local environment, but more or less affects and is affected by other localities, and even by those far removed in point of distance, but brought close by the mediumship of railroad and telegraph. This is the essential necessary for extensive organization, and why it does not pay to stay at home too close, in contact with the petty whips and stings of fortune. Necessity for recreation should alone spur up our people, and when to this is added a business necessity that requires men to meet together, there is every reason why the meetings at Warsaw and Toledo should be fully represented.

SELECTED MISCELLANY.

GOLD IN A METEORIC STONE.

GEOLOGIST H. W. TURNER, of Washington, D. C., who, for two years past, under the auspices of the California Division of Mining Geology, has been exploring the gold regions of the Sierras, recently obtained from a gulch at Cave City, Calaveras county, a meteoric stone that will create no little interest in the scientific world. It is about as large as one's fist, and around a good portion of it is a solid flim of gold. In one place the gold shows for about an inch square of surface. Hitherto in all the discoveries of the world no meteoric iron has been found in connection with gold. It demonstrates, Mr. Turner says, that there is gold in the worlds of space from which the meteor has fallen."

The above, from the San Francisco *Examiner*, is a curious corroboration of the evidence that has been accumulating in favor of a cosmical origin of earthy matter. In an earlier issue STONE presented recorded instances where meteors contained diamonds. The commonest metallic constituents of meteors are iron, nickel, cobalt, carburet of iron and gaseous hydrogen in great volume. Spectroscopic analysis indicates that the star Aldebaran contains much gold, and despite the view of Mr. Turner, which in its roundabout travel, we may have misunderstood, the evidence is accumulating in favor of the unity of the matter that composes the universe—a conclusion that theoretical considerations of the conservation of force renders most probable.

RED BEACH GRANITE.

ABOUT fifteen years ago the Maine Red Granite Co. was formed for the purpose of quarrying, cutting and polishing the red granite which exists in such vast quantities in the vicinity of Red Beach. They have just opened a new quarry which promises great results. The granite here lies in sheets and has a perfect rift, greatly reducing the cost of quarrying. The company owns a large track of land in the vicinity and the granite crops out in every ridge. They also have a quarry of beautiful black granite, from which some very fine monuments have been made. The cutting and polishing mill at Red Beach is one of the best equipped in the state of Maine. All the latest, most improved machinery may be found here.

THE WASHINGTON BRIDGE OVER HARLEM RIVER.

BRIDGE architecture will scarcely produce an equal to the bridge over the Harlem river recently finished, connecting Tenth avenue on west or New York side of the Harlem river with Aqueduct avenue on the eastern side a distance of 2,375 feet. The bridge has a height of 135 feet and is composed of two steel arches, each having 510 feet span, three piers and two

abutments. It has a roadway 80 feet wide, 50 feet of which is the carriage way, and two sidewalks of 15 feet each, which are protected by handsome balustrades of iron and bronze. The main piers are 40 feet thick at the springing line of the steel arches and 98 feet long. It is from designs furnished by the Union Bridge Company. The work was begun July 20, 1886, completed December, 1888; cost, $2,648,784.55.

The granite used was from the quarries of Biddeford, Mt. Waldo, and Vinalhaven, all on the coast of Maine. The cornices, parapet, etc., were from a finer quality of granite from the Mt. Waldo quarries. The light gray gneiss ashlar for the long faces of the piers was from the Mine Hill quarries near Roxbury, Conn.

The cement chiefly used was from the New York & Rosendale Works. It was of excellent quality; tests for tensile strength of pure cement in twenty-four hours ranging from 80 pounds to the square inch to over 130 pounds, the average of over 2,000 tests being 96 pounds tensile strain to the square inch. Nearly 40,000 barrels were used.

HARDENING AND TEMPERING TOOLS.

William Jessop & Sons, of Sheffield, England, the celebrated makers of cast steel, print the following in their circulars, respecting hardening and tempering tools:

No general, fixed rules will apply. It cannot be taught from a book. Only experienced persons should make the attempt, and the process depends upon the character of the work. Hardening is caused by suddenly abstracting the heat, and the quicker this is done the harder the steel. The two great evils to be avoided are burning in the fire and "clinking" in the water, both of which are caused by overheating the steel. At the utmost, only a low red heat, is required, and the lower the heat that effects the object, the better for the steel. The heating may be done in a coal or charcoal fire, or in a furnace, or in hot lead, according to the character of the work. Large steel articles are liable to crack if taken out of the water before they are thoroughly cold. Plain water with the chill off, say at 60 degrees Fahrenheit, will generally give sufficient hardness; but brinish liquids and chemicals mixtures, the ingredients of which are kept secret, are often used. Oil sometimes best suits the purpose, and cottonseed oil specially prepared is very useful. After hardening, steel is very brittle and unfit for use until tempered; this is done by carefully reheating slightly.

ALMOST 1000 YEARS AGO.

An immense wooden box, bound in iron, was recently found at Helsinfors, in Finland, by workmen engaged in excavating in the cellar of an old house. Upon opening the box the men found that it contained a large parchment and a quantity of pieces of iron of odd shapes. Being unable to make out the contents of the parchment they carried it to Mr. Rizeff, the nearest magistrate, who found that it was written by Father Suger, one time minister to Louis VII, of France, who reigned in the twelfth century. It was an elaborately written treatise upon the use of steam as a motive power, and further examination revealed that the bits of iron were numbered parts of a rudimental but complete steam engine. It is proposed to fit the parts together and to exhibit this pioneer steam engine at the World's Fair.

WITH OR AGAINST THE SUN.

Many people are at a loss to understand what is meant when it is said that a motion is with or against the sun. Or that a machine, or perpendicular shaft, runs with the sun or against the sun, as the case may be. A very simple method of learning what is meant is to stand facing the sun and turn around to the right; the motion will be with the sun; on the contrary, if the turn is made to the left the motion is against the sun. If still unable to

apply the knowledge thus gained to a moving shaft or machine, stand with the left side next the shaft in a position facing the sun, and if the shaft turns toward you it is running with the sun; if turning away from you it is running against the sun. Circling to the right is with the sun, circling to the left is against it. These instructions apply to all that part of this sphere north of the equator. When we get south of the equator the order is reversed—*Mechanical News*.

A USEFUL HINT.

A CORRESPONDENT of the *American Miller*, in answer to an inquiry for a means to prevent water kept standing in barrels, as for instance, those for fire protection in various parts of a mill, from getting foul, and smelling, recommends that an ounce of salicylic acid dissolved in each barrel of water will effectually prevent it. The smell is due to the putrefaction of the organic matter contained in the water. Almost any germicide would serve an equal purpose.

VARYING EFFECTS OF OILS UPON METALS.

LUBRICATING oils have varying effect upon different metals, and men who have charge of machinery have not given this matter nearly the attention that it deserves. Oils should be selected with reference to the metals they are to be used on, as recent experiments, whose results were given in *Iron Industries* show: Iron is least affected by seal oil and most by tallow oil. Lead is least affected by olive oil and most by whale oil; whale, lard and sperm oils act to very near the same extent on lead. Brass is not affected by rape oil, least by seal oil, and most by olive oil. Tin is not affected by rape oil, least by olive oil and most by cotton seed oil. Zinc seems not to be acted upon by mineral lubricating oils, least by lard oil and most by sperm oil. Copper is not affected by mineral lubricating oils, least by lard oil and most by tallow oil. Mineral lubricating oil has no action on zinc and copper, and acts the least on brass and most on lead. Olive oil acts least on tin and most on copper. Rape oil has no action on brass and tin, acts least on iron and most on copper. Cotton seed oil acts least on lead and most on tin. Sperm oil acts least on brass and most on zinc. Whale oil has no action on tin and acts least on brass and most on lead. Seal oil acts least on brass and most on copper. From these results it will be seen that mineral lubricating oil, has, on the whole, the least action on the metals employed in the experiment, and sperm oil the most. For lubricating the journals of heavy machinery, either rape oil or sperm oil is the best to use in mixture with mineral oil as they have the least effect on brass and iron, which two metals generally constitute the bearing surfaces of an engine. Tallow oil should be used as little as possible, as it has a bad effect on iron.

GREAT DAM IN AUSTRALIA.

OFFICIAL details of the great dam at Beetaloo, Australia, correct some of the previously published statements and figures, and the immensity of such a piece of engineering work may well challenge a comparison with anything of the kind in that part of the world. The structure is of concrete, 110 feet high from the bed of the creek to the top of the dam, and 580 feet long, being curved in the plan of a radius of about 1,400 feet; the width of the top is fourteen feet, the profile of the section being designed in accordance with Rankine's rules, and the width of the section at the foundation 110 feet; the crest of the bywash, which is 200 feet wide, is five feet below the crest of the dam, and the reservoir behind the dam at its full one and one fourth miles long, with an average width of eight chains. The capacity, under these conditions, is 800,000,000 gallons, for the supply of a district covering an area of 1,700 square miles, including eight separate townships, etc. The quantity of concrete used was

60,000 cubic yards, the net time occupied in construction being about two and one-half years. Special machinery was used for mixing the concrete and depositing it in place, and the whole work is regarded as a most creditable achievement.

A NEW LUBRICATING MATERIAL.

A NEW form of lubricant had been produced by Herr Krause, a German chemist. Soap, formed by treating wool grease with alkali, is dissolved in water and filtered, and a solution of alum or other alumina salt is added when a brown precipitate, called aluminum eanolate, is thrown down. When dried, this substance may be used for makinglubricating oils of any desired viscosity by dissolving it in fluid mineral oil.

CHEAPER AND BETTER THAN ROADWAYS.

AT a meeting of a farmers' club in Illinois an address was made advocating the constructing by rural communities of light railways along the section lines, with a switch to every farm, in lieu of the building of macadamized roads. The author declared that the day of transporting freight by horse power has passed, and that it will cost more to place the mud roads of the West in proper condition for teams than to build light railways.

HOW TO KEEP BOXES TIGHT.

KEEPING boxes tight, so as to prevent knocking or heating, is a problem that troubles many engineers, and it is often quite a little while before an engineer can get the "hang of it," as the expression is. An engineer with whom we talked once had as his particular watchword to take up his bearings just after stopping, never before starting; but whenever keying up is resorted to, the engineer is careful first to locate the looseness and not take up at the wrist pin for a knock at the crank pin. First settle where the knock is and then go slowly with it. It is not alike on every engine and some will run tighter than others. In large, heavy engines, or in fast-running engines, liners or shims should be inserted between the brasses and so dimensioned that the parts may be set hard upon them. As the bearing wears these liners are adjusted by a careful use of the file.—*Boston Journal of Commerce.*

INVENTION OF SATAN.

THE set screw is an invention of the devil. Either you want a piece to stay where it is without adjustment, or you want to adjust it in position. The set-screw permits of neither to any great degree. It slips if you want it to stay, and holds on like grim death when you want it to back out. If you ever had to drill one out which had been broken off in its hole you would not be so in love with them. Look how they score up good shafts so that if you want to move the pulleys along you can never use the places where they were for bearings. A compression hub is the only way to hold a pulley on a shaft.—*Dixie.*

TREATING HOT JOURNALS.

MANY mill operatives persist in applying oil to hot journals. A great many mills from that cause are devoured by flames, and a "mysterious origin" is said to have been the source. When a miller makes such a mistake he does not like to acknowledge it as a rule, though some are honest enough to do so, which accounts for the source of this information, and the investigation resulting in the knowledge of a remedy. When you find that you have a hot spindle to deal with, don't get excited and stop the machinery—that would be almost as bad as

to apply oil. If the spindle is very hot, and you shut down suddenly, it would freeze, and "spindle freezing" is not the easiest thing in the milling business to overcome. A mixture of one part of sulphur and four parts salt, applied before the machinery is stopped, will cool the hot spindle and prevent freezing, as well as at once arrest the dangers of a blaze.

THE PLAGUES OF EGYPT FORETOLD.

A PROPHET in Athens, Ga., predicts that the crop yield this year throughout the country will be the largest ever known, but that beginning with 1893, and for two years thereafter, there will be the greatest famine the world has ever known. "During that time rain shall cease to fall, and the streams of the country will all dry up, vegetation will no longer exist, and all animals will surely die. At the beginning of the famine the land will be infested with all sorts of vermin, and the living will suffer untold tortures."

LIQUID GLUE.

A GLUE always ready for use is made by adding whisky to any quantity of common glue, says an English furniture trade journal. Put both into a bottle, cork it tight, and put it by for three or four days, when it will be fit for use without application of heat. Glue thus prepared will keep for years, and is at all times fit for use except in very cold weather, when it should first be set in warm water. To avoid the stopper getting tight by glue drying in the mouth of the vessel, use a tin vessel with the cover fitting tight outside, to prevent the evaporation of the spirit. A strong solution of isinglass made in the same way is a very good cement for leather.

AN ENGINEER'S HAIR-BREADTH ESCAPE.

ENGINEER C. E. WORRELL, of the Soldiers' Home, at Marion, Ind., recently met with a strange and nearly fatal accident while engaged in repairing the boilers. The water had been drawn off of one, and he entered it through a small man-hole at the rear. After finishing his work he called out to his assistant to turn on the cold water, thinking to make his way out immediately.

By mistake the fellow turned on the scalding, steaming stream from the other boiler, the hissing and pouring of which made a doubly dense roar in the resounding cylinders, and coming at the entrance of the man-hole effectually barred the exit, and made escape from a terrible death almost impossible. Creeping as close as he dared to the seething stream he shouted to his aid to turn off the water. He could hear the fellow moving around among the pipes, but waited in vain for him to come. The man had not heard him. His voice was stopped by the hissing, boiling, mocking water. It was rising among the pipes at his feet. A few moments more, he thought, and he would have been cooked alive. There was but one chance left open—to force himself through the scald of water and out the man-hole. Delay any longer would be fatal, and he plunged face and hands through the cooking stream into the air beyond. Just then the water stopped.

INVENTION OF THE STEAM ENGINE.

An extraordinary archæological find is reported (we know not with what accuracy) from Helsingfors, in Finland. It consists of a huge chest with complicated fastenings of iron, which, together with the other details of its structure, point to a date early in the middle ages. On being opened, the *St. James Gazette* says, it was found to contain a quantity of ancient ironwork and a large roll of parchments, which were at once placed in the custody of

M. Nicholas Rizeff, one of the chief magistrates of the town. The manuscripts begin with the following words: "*Suger presb. abb. S. Dion dixit* . . ." Then comes a complete and detailed treatise in Latin on steam considered as a force and on its applications—in short, a very accurate discourse on modern physics. It is stated that the ironwork forms a rudimentary steam engine, the cylinders, pistons and other parts of which had been taken to pieces, but are wonderfully fashioned, considering their antiquity. Each piece bears the inscription, "*Suger parens Galliæ fecit.*" Suger was the well known administrator under both Louis VI. and Louis VII. During the absence of the latter in the Holy Land he acted as regent, and for his able services received from the king the title of "*Pere de la patrie.*" He himself died in 1152, when on the point of starting on a crusade.

VESTED RIGHTS TOO STONG.

ENGLISH sculptors are disgusted over the failure of the Glasgow enterprise which was to reopen the quarries in the Island of Paros, which are known to have furnished the ancient Greeks with some of their best marbles. The specimens which were brought back by the engineer sent out from Glasgow to investigate the quarries were of a fine rosy color and a beautiful grain. Mr. Stirling Lee and Mr. Onslow Ford were emphatic in giving the marble preference over that of Carrara. But British capitalists have locked up millions in Carrara, and in Paros quarries will have to remain undeveloped until other and less burdened men take them in hand. The marble would be cheaper than that of Carrara.

CANNON ROCK.

ON the Sioux Reservation, in South Dakota, is a large rock, standing on a mound, which by the action of frost, wind and rain has been shaped into a striking resemblance to a cannon. Its resemblance to a piece of modern heavy ordnance is striking, and rendered more so by its being set, like a rocking stone on the top of a conical hill, from where ages of erosion have denuded all except to hard stone forming the "gun," and the almost realistic foundation it rests upon, that bears no slight resemblance to the carriage.

FLOORS OF PLASTER OF PARIS.

THE French, who have carried the art of hardening plaster to where it is utilized for flooring, either in place of wood or tile, use six parts of good quality plaster intimately mixed with one part of freshly slaked white lime finely sifted. This mixture is then laid down as quickly as possible, care being taken that the trowel is not used on it for too long a time. The floor should then be allowed to become very dry, and afterward be thoroughly saturated with sulphate of iron or zinc—the iron giving the strongest surface, the resistance to breaking being 20 times the strength of ordinary plaster. With sulphate of zinc the floor remains white, but when iron is used it becomes the color of rusted iron; but if linseed oil, boiled with litharge, be applied to the surface, it becomes of a beautiful mahogany color. Especially is this the case if a coat of copal varnish be added.

SUCCESSFUL MASONRY WORK IN COLD WEATHER.

SPEAKING of masonry laid in very cold weather the *Deutsche Bauzeitung* says that at Christiania, in Norway, building operations are successfully carried on at temperatures as low as 2° F., and that the work executed under these conditions compares favorably with sum-

mer work. In fact the Christiania builders maintain that it is superior. The secret of successful work under these conditions is said to be in the use of unslaked lime in mixing the mortar in small quantities at a time, being made up immediately before use. The mortar must be put in place before it loses the heat due to the slacking of the lime. The lower the temperature the larger the quantity of lime required, so that below 12° F., the work cannot be carried on profitably.

WHY WE SHOULD TEACH GEOLOGY.

GEOLOGY in its broadest scope should be taught in our schools and colleges, and for at least twelve good reasons, says Prof. A. S. Packard in *Popular Science Monthly* for May. At the outset we would claim that it holds equal rank with astronomy or biology. The former science tells us of the existence of other worlds than ours and gives us some conception of the immensity of space. The study of plants and animals carries an impressive lesson as to the unity prevailing amid all the diversity of Nature, besides affording the hope that we may at some time discover the origin of life, since it has already opened the way to an explanation of the origin of the existing forms of life; while the grand outcome of geological study is that it brings vividly before the mind the immensity of time, enabling us to realize that time is only less than eternity It also teaches us that our earth has had a history, that our own race has had a high antiquity; and thus the contemplation of past geological ages reckoned by millions of years, the fact that our earth is coeval with the sun in age—all these considerations tend to immeasurably expand our mental horizon, and thus to react in a way to broaden the mind. Geology is also the complement of biology. As soon as one has mastered the rudiments of botany and zoology, and of the distribution of life forms in space, the range of his thoughts should be extended to take in the orderly succession of life in past ages, and the evolution of modern specialized plants and animals from the earlier types.

JAPANESE ROAD LAW.

JAPAN has had good roads for some centuries, and the Kioto-Tokio highway, 307 miles long, was noted for its excellence as long ago as 1691, when it was traveled by the Dutch explorer Kaemfer. But as their new civilization introduced new vehicles of traffic, the Japanese, in 1875, framed new laws for the general construction and maintenance of highways. This law, by which all roads are classified, is modeled somewhat on the French system and divides them into national, prefecture and village roads. The national roads are built and kept in repair by the state, the work being done by the prefectures along the line. The second class of roads is kept up at the joint expense of the state and the prefectures each paying one-half. And the village roads are built and maintained by local taxation under the engineering authority of the prefecture. The administration is said to be excellent, and what money is expended is in the line of efficient work.

THE CAMPO SANTO AT GENOA.

TRAVELERS to Genoa, Italy, have not seen all the unique sights of that interesting locality until they have visited the *Cimetero di Staglieno*— the celebrated *campo santo* or burial place. It is beautifully situated on a slope of the valley of the Bisagno, a mile and a half from the city, with the water system of which it is connected by pipes. It covers a space of about 600 feet square, and was laid out in 1867 with considerable taste. Interments are made in the open ground in the center, and while the arrangement of this part of the cemetery is interesting, the unique and beautifying feature is the double gallery which runs around three sides of the square, the outer one being used for interments and plain wall burial. The

marble shelves rise to a height of some twenty feet, and the coffins having been placed thereon are sealed in with a plain marble slab bearing name, date, etc. The inner gallery is open on one side with arches to the central portion of the inclosure, and here the sculptor has been given a clear field. The arched niches on the one hand and the open arches on the other are filled with statues and monuments, some of them commonplace enough, but many of them among the best work of the Italian sculptors. One of the finest is that of Marchese Taliacarne. One is disposed to overlook some of the cheap metallic and porcelain effects in wreaths, flowers, etc., in the presence of a whole which is not only solemn and imposing, but grand. The rotunda in the upper row is made attractive by massive monolithic columns of black marble, which support the internal gallery. At the upper end of the cemetery is the tomb of Giuseppe Mazzini, who died in 1872.

The fourth side of the square rises several feet above the others and has a chapel in the center, which is approached by a wide flight of marble steps. The wings connecting the chapel with the side galleries are filled like the sculpture mostly of a high order.

TRANSCASPIAN SULPHUR DEPOSITS.

A SYNDICATE of Moscow capitalists will shortly, it is said, commence to exploit the rich Transcaspian sulphur deposits. Operations were begun some years ago, according to *Iron*, but they failed owing to the difficulty in separating the sulphur from the clay contained in the crude ore both by the calcarone and the superheated steam processes. The new undertaking, which has a large capital, will extract the sulphur by means of solar oil, a number of experiments with this method as applied to Transcaspian sulphur having yielded the best results. The promoters of the concern have natnrally in view the proximity of the acid works on the Volga and in Baku. The new industry, when developed, will operate to the disadvantage of the Sicilian market, which has hitherto supplied the districts named with the raw material.

HOW THEY DO THINGS IN FRANCE.

A CURIOUS phase of the labor question is reported from Paris, where an execution has been served upon the omnibus company by its men in the following circumstances. A court decision was rendered forbidding the company to keep its men employed for more than twelve hours a day, and in case the decree was not obeyed the penalty was fixed at 100 francs a day, to be paid to the syndicate of the men. The company ignored the decree, and the men continued to work for the statutory twelve hours, and for certain hours in addition. Thereupon the syndicate communicated with the company, but no notice was taken of the communication. The men continued to work during the forbidden hours, and the company continued to employ them. As the next step the syndicate claimed the penalty. But the company still pursued a course of masterly inactivity. It ignored the claim. Thereupon the syndicate became aggressive. A sheriff's man appeared at the bureau of the company, and asked for the full amount of the penalty from the day of the decision, and, the claim being ignored, seized tables, chairs, desks and office furniture. The defense of the company is that they have appealed against the decision. Meanwhile the men go on working overtime peace fully and contentedly as usual.—*New York Evening Post.*

LEGAL NEWS AND NOTES.

[Prepared for STONE, by V. H. Lockwood, Indianapolis.]

STOPPAGE IN TRANSITU.—When a man sends goods that have not been paid for to a purchaser, and after sending them learns that the latter cannot pay for them, or is insolvent, he can stop the goods before they reach the buyer.

The goods must be stopped before they are actually delivered to the buyer. If they are sent to pay a debt, which the seller owes the buyer, they cannot be stopped.

The right to stop goods is not defeated by part-payment, or the acceptance of a bill of exchange or a promissory note for part of the price, or by a sale on credit.

Stoppage of part of the goods does not affect the property in the balance. It belongs to the buyer, but the seller can hold what he succeeds in catching until the price for the whole bill is paid.

Goods can be stopped only when buyer is actually unable to pay for them. If he tenders payment, or offers good security, when sold on credit, they must be released.

The stoppage must be by the seller or his authorized agents. It is not necessary to take possession of the goods but notice must be given to the person who is carrying or in possession of the goods before delivery to hold the goods, and not deliver them to the consignee. This notice must be given to the person directly in control of the goods, or, if to his superior in time to reach the person in actual control before delivery.

The seller cannot subsequently ratify a precedent unauthorized stoppage.

Goods can be stopped although the carrier be specially appointed by the purchaser to receive them, or the goods be in the charge of general forwarding agent of the purchaser.

When the right of stoppage in transit does not exist: (1) When the goods are fully paid for, if no credit be given; (2) when, if credit is given, ample security is given or offered; (3) when the buyer is not legally insolvent; (4) when the buyer has sold the goods to a purchaser in good faith and for value, before they are stopped, and has indorsed and delivered the bill of lading or freight bill to him. A mere agreement to sell the goods or to indorse the bill to the second purchaser will not destroy the right to stop the goods. The bill of lading must be indorsed; a mere delivery of it will not suffice. If the second buyer gave nothing for the goods or bill of lading, or if he knew of the insolvency of the first buyer, when he took the bill, he will be in no bettter situation than the first, and the stoppage is good. If the first buyer has pledged the goods or bill of lading to an innocent creditor of his, the goods may be stopped, but the seller is entitled, not to all the goods, but only to the surplus after satisfying the charge of the creditor to whom they are pledged; (5) when the goods are delivered to the buyer or to his agent; (6) when the goods are on the buyer's wharf, or on a neighboring wharf with notice to him; (7) when they are in the warehouse at the termination of the shipment and the warehouse key has been delivered to him; (8) when he has a warehouse order for the goods; (9) when he has demanded them and marked them at the end of the shipment; (10) when the carrier holds the goods only as agent of the buyer. But if the carrier only holds them for his charges, the seller can have them on payment of the charges; (11) when the goods are being carried in the buyer's own cart or carriage or vessel under the care of his own servant.

The duty of the seller after stoppage. By stopping the goods, the seller does not invalidate the sale, but holds the goods as the property of the buyer, by way of pledge or security for the payment of the price. They may be obtained by the buyer or his assignee, executor or administrator by paying the price.

If they are not redeemed within a reasonable period, the seller must give notice to the buyer of his intention to sell them and the time and the place and manner of selling them, so that the buyer can protect his interest. At the proper time after such notice the goods must be sold in good faith so as to obtain the highest price for them. If the price they bring including cost of sale is less than the full price due, the seller has a claim against the buyer for the balance; but if more, the surplus above

the full price and costs of sale must be paid over to the buyer or to his assignee.

PATENTS.—A patent will be issued to any person who has invented or discovered any art, machine, manufacture or composition of matter, or any improvement thereof, which is new and useful and which has not been known or used by others in this country, or patented or described in any printed publication in this or any foreign country, or has not been in public use or on sale for more than two years, unless such use or sale has been abandoned.

The mere fact of prior use, invention or discovery abroad, will not prevent the issue of the patent here, unless the invention has been patented or described in some printed publication there.

Where a patent is first taken out in a foreign country, it will be granted here only for the shortest term of the foreign patent, and in no case for more than 17 years.

If the inventor die, the patent may be applied for and will be issued to his legal representatives.

One of two joint inventors cannot claim a patent separately.

The period for which a patent is granted is 17 years, during which time the owner of it has the exclusive right to *make*, *use*, and *sell* the invention or discovery, throughout the United States.

The assignment of a patent or any interest therein is effected by an instrument in writing. It must be recorded in the patent office within three months from its date, or the assignment will be void as against a subsequent purchaser mortgagee for a valuable consideration and without notice of assignment. No particular form is required provided the assignment is complete.

The assignment may be for the whole or any part of the United States.

The right to patent may be assigned before the patent is obtained, and then, if the assignment be recorded in the patent office, the patent will be issued directly to the assignee, or, if an undivided part be assigned, to the inventor and assignee jointly.

Assignment of inventions will not be recorded before allowance of patent.

Licenses and shoprights will not be recorded.

Infringment of a patent right will be prohibited by the courts and the damages sustained may be recovered from the infringer.

The owner of a patent is required to give notice to the public of his patent right, either by affixing to the machine or article the word "patented" with the date of the letters-patent or in some equivalent manner. If notice be not thus given no damage can be recovered for any infringement by an innocent person without notice of the patent.

Any person who *makes*, *uses* or *sells* a patented article or machine without permission of the owner is an infringer. It must not be made without authority, although it be neither used nor sold; nor sold, although made by another; nor used by anybody. A person cannot make it for his own private use.

An infringement takes place when a person in making a machine or article avails himself of a patented invention without such a variation as will constitute a new invention, or when he makes a copy after and agreeing with *the principle* laid down in the specification in the letters-patent. Any arrangement of mechanism which performs the same service or produces the same effect in substantially the same way as a patented machine is an infringement.

There is no infringement when the same results are obtained from another kind of machine.

A patented combination of elements is not infringed by the use of one or some parts of the combination or by a materially different combination of the same elements.

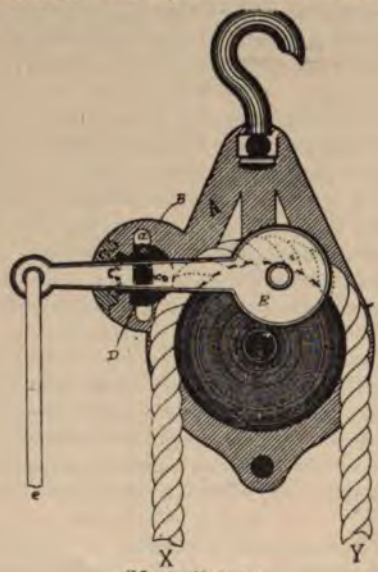
A person can invent improvements in a patented machine, but he cannot make, use or sell the machine with his improvements attached, nor can the owner of the machine make, use or sell the patented improvement or add it to his machine, without permission from the owner.

The use or sale of articles produced by a patented machine or process is no infringment, unless the patent covers by its terms both process and product.

If one has obtained the exclusive right to use a machine and sell it to others for use in a specified territory, he has also the right to sell the articles made by such machine anywhere in or out of such territory.

RECENT PATENTS.

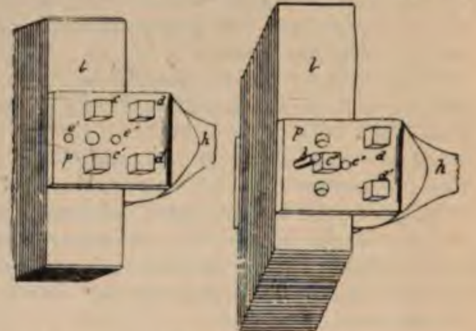
AUTOMATIC BRAKE PULLEY-BLOCK.—This is a combination of the ordinary pulley-block, with an extension arm (B) as a part of the case, the arm being provided with slots (as *a*), a rack (*c*), engaging with a pinion (D), with the shaft



(No. 468,901)

(*b*), the weighted lever (E), secured to the shaft of the pinion. This is No. 468,901, invented by Horace W. Laman, of Mlllport, N. Y., and assigned to Jas. M. Rose, of Syracuse, N. Y.

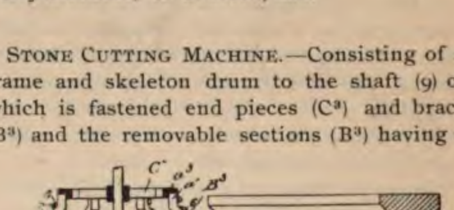
GRANITE HAMMER.—The improvement is in the handle and its clamping device for holding the blades. To the handle is fastened metallic clamps, perforated to received the bolts, and a peg (*i*). The blades are perforated at the middle by a slot, so that when the blades are all brought into position for grinding they



(No. 469,040.)

will stand opposite to each other and receive the peg. It is No. 469,040, and the invention of Perry Denham, of Sanford, Ind.

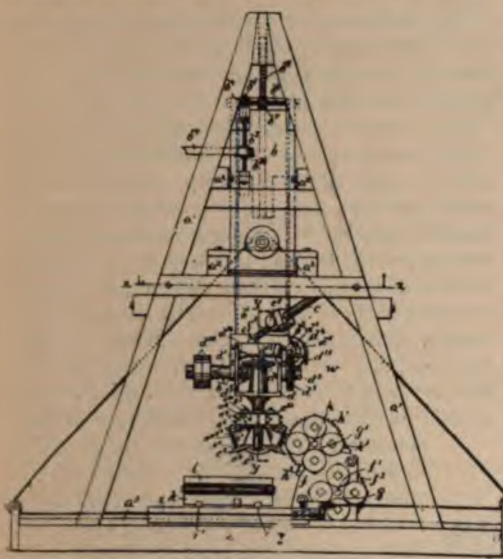
STONE CUTTING MACHINE.—Consisting of a frame and skeleton drum to the shaft (9) of which is fastened end pieces (C^3) and brace (B^3) and the removable sections (B^3) having a



(No. 469,091.)

series of spirally arranged notches having reinforcements larger than the projections, and carrying cutters, with means for securing them in place. It is patent No. 469,091, invented by Louis Prince, of Washington, D. C.

MACHINE FOR DRESSING STONE.—In this machine for cutting and dressing stone, a chuck is provided with means to positively rotate it, the chuck containing cutters, and be-



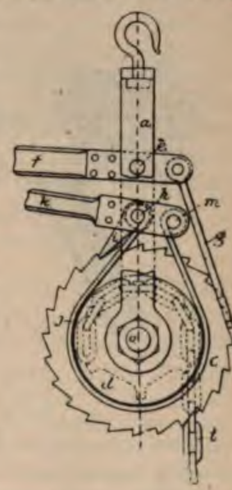
(No. 473,850.)

ing adjustable, so that the cutters may be carried at the inclination required to cut a desired molding. The chuck is operated by the movable plate b', of a telescopic brace ivotally attached to the frame a' and to the

(No. 470,240.)

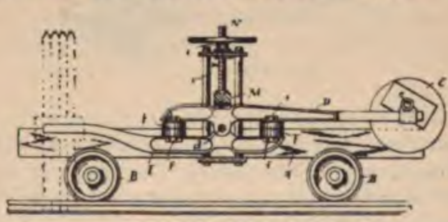
movable plate b', consisting of a rod c^2, and a tubular portion c, provided with a clamping-plate c^4, and a set screw c^5 to rigidly clamp the rod and tubular portion together. Another chuck is provided, so arranged that the two chucks positively rotate in opposite directions, one of them being adjustable concentrically with the other, thereby adjusting its cutter with the other chuck, the cutters of both chucks also being each adjustable and free to turn in contact with the stone. One of the chucks being adjustable endwise in its bearings in a line parallel with the length of the shaft of the other chuck and into a cutting plane parallel to that of the other chuck. This is patent No. 473,850, and the invention of Alexander McDonald, Cambridge, Mass.

HOISTING MACHINE.—This consists of a suitable yoke, a sprocket wheel, a racket wheel, a friction pulley set on a shaft journaled in the yoke, a lever having a swing link, adapted to engage the racket wheel, and a swinging pawl adapted to engage the rachet wheel, together wtih a friction band passing around the pulley and a lever fulcrumed in the yoke adapted to operate the band. This is patent No. 473,655, and was invented by Martin Curran, of Deering, Me.



(No. 473,655.)

TACKLE BLOCK.—The strap sections are each constructed with a neck portion, a hook held in the neck, and a ring around the neck for holding the various sections together. The separate strap sections form the support for a sheave, and are each provided with a part of a neck for holding the hook, which turns freely in the neck. It is patent No. 470,240, and the invention of Henry V. Hartz, Cleveland, O.

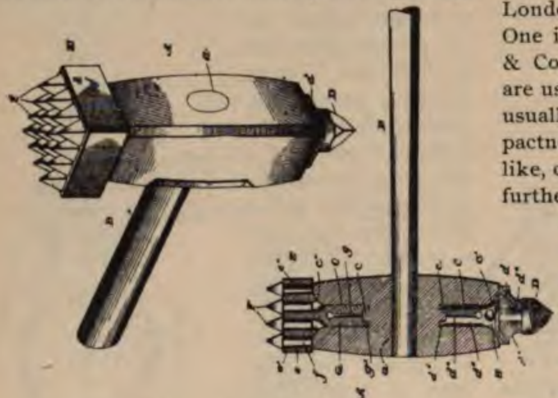


(No. 471,265.)

STONE CHANNELING MACHINE.—This consists of a cutter lever, pivoted at the center

where the ends of the sections overlap and spring buffers on opposite sides of the pivot point between the lever sections. The lever is formed in two sections, one above the other, with the spring buffers between the overlaping sections, and is held in position with a yoke in which the inner ends of the sections are pivoted. It is patent No. 471,265, invented by William Bryant, North Amherst, Ohio.

TOOL FOR DRESSING STONE.—This is a hammer, having circular tapered recesses in each end and the detachable cutting and dressing



(No. 470,788.)

tools having circular shanks, split lengthwise, forming spring tongue adapted to be inserted within the tapered recess, and provided at their ends with squared notches adapted to engage

(No. 21,474.)

over the square projections, to prevent the tool from turning. The patent, No. 470,788, was invented by George Ladiapelle and Charles E. Devine, of Williamsport, Pa.

DESIGNS FOR MONUMENTS.—Patents Nos. 21,474 and 21,175, refer to two designs for monuments, both by Wm. H. Perry, Concord, N. H. The cuts fully describe them.

DEVELOPMENT OF THE GAS ENGINE.

The fulfillment of Bramwell's prediction, that the steam engine would be driven out of existence by the gas engine, is somewhat slow of accomplishment, remarks *Engineering*, London. It would seem, however, that the cloud, "small as a man's hand," which Sir Frederick's eye saw, has grown to a very respectable size, when we find gas engines being erected in London capable of yielding 170-horse power. One is now at work in the flour mills of Mead & Co., Chelsea, England. When gas engines are used of these dimensions the reasons which usually determine their choice, such as compactness, ease of management, safety and the like, cease to be sufficient, and we have to look further to find the causes which lead to their selection. The engine in question is situated in a large mill, where there is plenty of skilled attendance and ample facilities for dealing with coal and ashes. The work is continuous for fifteen hours out of the twenty-four, and the amount of power required is large, so that in no respect do we find the conditions popularly associated with the use of gas engines. The cause of the selection is to be found in the

(No. 21,175.)

economy in fuel that can be obtained with gas engine worked by Dowson gas. In such a motor it is possible to reduce the expenditure to below one pound per indicated horse power per hour, not merely under selected conditions, such as often prevail at a trial, but in every-day work.

SCATTERED FRAGMENTS.

Several Polish boys stole a can of powder from a stone quarry near St. Cloud, Minn., and threw it in an open fire. Barney Omersky and Pane Craft may die. The survivors were badly injured.

The Rialto bridge, Venice, is said to have been built from designs furnished by Michael Angelo. It is a single marble arch of 98½ feet.

The Turkey creek hogback, near Denver, Col., recently became noted for its hone and whetstone deposits, has produced another treasure that adds to the importance of the wonderful acquisition of the Honestone company. Onyx of a superior grade has been uncovered, and an estimate made of the extent of the deposit, which possesses all the rich coloring and beautiful tracery of the Mexican article, which is exclusively used in the United States for interior decoration. Onyx works have been established in Denver, and as soon as the stock on hand runs out, the Jefferson county onyx will be cut and polished for the interior of the Brown hotel, which calls for $20,000 worth of the beautiful stone.

Among the twenty-five Japanese who were sent back to Japan on the China a few weeks since, were thirteen who were found to have come to this country under contract as stonecutters. These men were under a contract to work for three years at stone cutting at $1 a day. They all claimed to be good workmen.

At noon on May 22 a premature explosion took place in a quarry on Clegg's lane, near the river road, West Manayunk, Pa., owned by the Pencoyd Iron Works. The fragments of stone were blown across the river and came crashing down on the roofs of dwellings, stores, mills and stables, in the yards and upon the streets in Manayunk. The building 4219 Main street, occupied by Mrs. A. C. Conahue, a milliner, was damaged by a rock, weighing nearly 100 pounds, striking the cornice, and crashing through the roof of the back building, and after striking a bed and breaking several articles of furniture, landed on the floor. Two children had been playing on the bed but a few minutes before the rock came in. William Welsh, while passing along the street, was struck by a stone and injured on the neck. No one was hurt about the quarry.

At a special meeting of The York and Peach Bottom Slate Manufacturing Company held at York, Pa., on May 24, the following officers were unanimonsly elected to serve for the ensuing year: President, Edward M. Vandersloot; Treasurer, R. Hathaway Shindel; Secretary, William H. Souder.

The perpendicularity of a tall monument is, although few may be aware of it, visibly affected by the rays of the sun. On every sunny day a tall monument has a regular swing leaning away from the sun. This phenomenon is due to the greater expansion of the side on which the rays of the sun fall.

The American Monumental Association of Pittsburg are preparing to have erected a $10,000 life-size marble figure of Abraham Lincoln mounted on a pedestal. J. A. Itzel, of Allegheny, is engaged on a drawing of a monument, and the association invites public subscriptions for their undertaking.

The legislature of Ohio has appropriated $25,000 for a monument typifying the greatness of that state. The monument, executed in bronze, will be seventeen feet high. It will be put up in front of the Ohio building of the world's fair and afterward removed to Columbus and erected in front of the capital. Life-

sized figures of Grant, Sherman, Sheridan, Chase, Stanton and other sons of Ohio will be grouped around the granite shaft. Cornelia, pointing to the inscription: "There are my jewels," will stand on a pedestal above the group. Levy T. Schofield, of Cleveland, designed the shaft.

William G. Marden, the oldest stone-cutter in New Hampshire, died in Manchester, N. H., May 12. He began the stone-cutting business there in 1848 and continued in the business until 1890, when it was sold out to the present proprietors, Palmer & Garmon. The busines had grown into large proportions.

General Horace Porter, president of the Grant Monumental Association, issued another appeal on May 23, begging the city of New York to subscribe the balance of $46,000 required to complete the $350,000 for the building of the Grant Monument. It was hoped to have the sum complete by Decoration day, but we have not heard of its relative success.

Every portion of soapstone lost in cutting is utilized in other ways. It gives the dull color to rubber goods, is used in paper to gain weight, and is also an excellent article to use in making fireproof paints.

A mammoth mantel and stone manufactory is to be added to the enterprises of Knoxville, Ky.

A very fine quarry of chocolate colored sandstone has been discovered near Graysville, Ga. The stone is in a mountain, lies on the surface and is in limitless quantities. It is a beautiful brown color with a suggestion of pink, sparkless of uniform shade, splits easily, is soft before exposure, and is regarded as the most valuable sandstone ever discovered in the South. The quarry is to be developed on an extensive scale.

The bluestone business of the Delaware river and also of the Lackawaxen river region opens up this season in a manner that is very gratifying to the owners and employes. It is stated by those competent to know that never before was the business, as a whole in such an excellent condition. The prices received are fairly good and the orders numerous.

D. M. Monty and John J. Cunningham, of Drake, Stratton & Co., Glens Falls, N. Y., have received the contract for furnishing cut stone to the extent of $40,000. A large number of men will be placed in employment at once. The Drake, Stratton & Co., limited, are the contractors for a large amount of cut stone for the McCombdam bridge, 155th street, New York City.

The Berkshire Granite Works of North Adams, Mass., have completed a granite monument, in which a monolith of granite weighing five and one-half tons will be placed. It will be rock faced except the four panels, which will be polished.

The $60,000 world's fair appropriation, which Greece has made, will be devoted in large part to the preparation for exhibit of reproductions in cast of the many famous specimens of ancient Greek art, now owned by the government. These casts, it is announced, will be presented to one or more American museums after the fair closes.

BOOKS AND PERIODICALS.

"It Came to Pass" is a novel by Mary Farley Sanburn, author of "Sweet and Twenty"—a summer story that proved her to be possessed with that keen sympathy that every one feels and appreciates. One soon gets so intimately acquainted with her that, should it happen, a formal introduction would not seem at all necessary. The new novel is full of pen pictures of out-of-door life, and the characters are healthy types of boys, girls, men and women, full of vigorous life. It is not of the sort of novels rather common at this time, where social homilies and economic hobbies are disguised by a plot and dialogue, but tells a story where the well-drawn characters take part in the inception and denouement of the romance and help to develop its plot. The heroine, alone, is a girl with undisciplined nature, romantic longings and girlish follies; Jack, the faithful lover, subject to all the whims of such a girl's nature, but confident of winning; Mrs. Martingal, the self-appointed inspector of cobwebs, general adviser and custodian is perhaps the most striking; care-ridden Lesley, unromantic Della and worldly, whimsical Mrs. Laney, are all living characters, such as we all have seen. The book is No. 19 of Lee & Shepard's (Boston) "Good Company Series." Price 50 cents.

Brainard's Musical World for May is full of beautiful new music and interesting reading matter. It contains four choice piano pieces: "Remember Me" by Brinkman; the celebrated "Barcarolle," op. 37 by Tschalkowsky; "Doubt," a beautiful tone poem, by Emery; and "May Bells," by Spindler. Also a charming new song by Fannie Snow Knowlton, entitled "I'm Yours, Sweetheart, Forever." The music in this number is alone worth $2.00. Mailed post-paid for 15 cents in stamps, or three back numbers mailed for 25 cents. Published monthly at $1.50 per year.

A "Record of Scientific Progress for the Year 1891" is a work that the title sufficiently defines, by Robert Grimshaw. It is a condensed description of the discovery, invention and scientific progress of the year in all branches of science and industry. It is designed for all those who have not the time or opportunity to follow up the work of the year, and for those who would wish a generalized statement that can be followed up more intensively, at will. The work shows exhaustive research, as well as complete knowledge of the sources of information, and the great number who are acquainted with the work of the author in special fields do not need to be told that he is thoroughly fitted for the production of just such a book. It is published by the Carrell Publishing Company, New York. Price $1.50.

Lippincott's Magazine for June is unusually varied in contents and rich in quality. The complete novel, which is a feature recently adopted in this magazine, in this month is "John Gray, a Kentucky Tale of the Olden Time," written by James Lane Allen. Historically, the olden times of Kentucky calls to mind an age of romance that might be styled the mythology of America, and imparted characteristics to her people that in districts are peculiar from their Arcadian simplicity. This has given the author an opportunity that he has not neglected, in producing his peaceful scenes. The Journalist Series is filled this month by Murat Halstead, who deals in reminiscence of the period represented by Clay, Webster and Calhoun, who were gradually personifying the causes of the great civil war.

Ex-Senator Ingalls has an article entitled "Westward the Course of Empire Takes Its Way," in his penetrating, nervous style. Other contributions on the West were furnished by Pro. John Bach McMaster in his "Struggles for the West," and by Wm. F. G. Shanks, "The Great American Desert." Maurice Thompson and Patience Stapleton have short stories that are fully up to their standard. James Whitcomb Riley, Ella Wheeler Wilcox, Gussie M. Best and others furnish poems.

The specification and contract blanks issued by Palliser, Palliser & Co., for the use of architects, builders and contractors, is the most complete set of specifications ever designed, and invaluable to builders and those who design buildings, as by their use they will save hundreds of pages in writing and copying, besides having a more complete, full and practical specification than is usually written. Blank spaces are left for details, which change with the difference in class and cost of houses, such as sizes of timbers and parts not shown on plans. Messrs. Palliser, Palliser & Co., have done the public, and mechanics especially, great service, in preparing these specifications, which obviate a great deal of writing, and tend to prevent errors by making all the points perfectly clear. It is printed on one side of linen paper 9 by 14 inches in size, handsomely bound in paper cover, with fastenings for pocket use. Price 50 cents per set, or $4 per dozen. Address Palliser, Palliser & Co., 24 East 42d street, New York, N. Y.

PUBLISHER'S ANNOUNCEMENTS.

The Ingersoll-Sergeant Drill Co., of 10 Park Place, New York, have opened a branch office under the firm Parker, Melcher & Ingraham, 100 to 104 West Washington street, Chicago, Ill., where a complete outfit of their machinery such as air compressors, channelers, rock drills, and all other mining, tunneling and quarrying machinery with duplicate parts will be kept in stock.

The Lidgerwood Manufacturing Co., have issued from their New York headquarters, 96 Liberty street, a forty page pamphlet, the third of their sketch-book series, bearing the title "Open Pit Mining." It is profusely illustrated with dainty pen and ink sketches, and full of valuable and interesting facts regarding the application of the company's celebrated Locke-Miller and Harris-Miller suspension cableways to open pit mining, quarrying and constrnction work.

Several views are shown of the Tilly Foster Iron Mines, Tilly Foster, N. Y., the concentrating works at Edison's Ogden Ore Mills, Tilly Foster, N. J., and the Dunnellon Phosphate Company's mines, Dunnellon, Fla., with the suspension cableways erected by the Lidgerwood Manufacturing Company at these well-known localities, also views of cableways used for building the Sodom dam, at Brewsters, N. Y., and the Austin dam, Austin, Tex. The last-named cableway is the largest ever erected, having a span of 1,350 feet.

The book contains as well some very strong testimonials which will be read with interest by engineers and contractors. "Open Pit Mining" is intended for gratuitous distribution.

The Lidgerwood Manufacturing Company now own or control over a dozen patents on cableways, notably those of T. S. Miller, M. W. Locke, N. C. Harris and C. M. North.

The Sullivan Machine Company of Claremont, N. H., and the Diamond Prospecting Company of Chicago, Ill., have united their interests in a company known as the Sullivan Machine Company with offices at Chicago, Ill., Claremont, N. H., Denver, Colo., and New York. They manufacture the well known Sullivan Channelers and Gadders, Diamond Core Drills and a full line of coal mining machinery. The Sullivan steel channeler has had a very unusual history: Placed on the market only three years ago, it has taken a very prominent position among machines of the same class, one concern alone having thirty of these channelers, and they are well known in all the stone quarrying regions of the country. Their steel gadders have been recently introduced and are giving most satisfactory results both to them and to the people who have purchased. Having had many years of experience in the manufacture of stone quarrying machinery, Sullivan Machinery Company hopes to at least "keep up with the procession" and to deserve the same liberal patronage that has been given to its predecessors by the quarry owners of the country. The officers of the company are F.

B—*Stone.*

SYLVESTER MARSHALL,

President National Association of Quarry Owners.

STONE

VOLUME V. JULY, 1892. NUMBER II.

THE ROAD PROBLEM.

SECOND RUMINATION.—ON THE WAY.

HE THAT HATH EARS TO HEAR, LET HIM HEAR."

MY earlier reflections were upon the danger and cruelties which accompany my destined occupation in life, and I intimated that my condition might be much ameliorated by an improvement in the other parts of the machine, for a wagon is of no more use without a road and a motor, than is a ship without water and wind, or steam. The wagon and the way are only complementary parts of a system, "useless each without the other," and, as in all mechanism, the best results are obtained when all the parts are in the best condition. It is very necessary, therefore, that each part should be adapted to the work it has to do and hence it is wise to look briefly at the requirements of these several parts, under the assumption that the motor is animal power.

The track or way should be such as to offer the least resistance to the traffic which is to pass over it. Now the resistance is composed of a variety of elements, already mentioned, but the most important are those of gravity and mud. Distance is less important if the hills are reduced or the road surface improved thereby; but the usual custom in the country is to zig-zag around the fields and farms, instead of taking the short-cut to the stations and towns, thus adding often 40 per cent. to the length of haul and taking that much more land from the farmer, while it adds just that much to the cost

A

of maintenance, hence it is a tax in both directions and every one who uses it is taxed in time and the wear and tear of teams, to the same extent. But every hill is a worse obstruction than is distance, for it takes much more force to lift a load up than it does to roll it on a level. In the latter case we have only to overcome friction; in the former, both friction and gravity.

The effect of a grade varies with the hardness of the surface and is more marked on the smoother than on the rougher roads, so that before our roads are metaled the slopes should be reduced. One single steep hill will control the load on a long line of road, just as the strength of a chain is found in its weakest link. I have noticed that the surface resistance is always greatest just after a thaw or a rain when the earth is softened and mellowed by the water passing into or out of it and have concluded that water is the enemy of traffic on an earth road. (see A.) I have no objections to water in its place, in the canal or river, and there I can do more with it by hauling great loads so cheaply that even the railroad cannot compete, but when it comes to a mixture of water and earth on which to float a load resting on four narrow points of support, I must give it up as one of the worst devices ever conceived of to torture a heart and try the patience of a man. I have tried in every possible way to convince my master that I am pulling out my internals in trying to overcome the mud which holds me back, even to getting a dynamometer fastened to my single-tree to show him how many pounds it takes to pull an ordinary load, but even then he does not appreciate it, so I have asked my friends who are interested in economics, and believe it good policy to save where you may, to make some figures, so the farmers and others can see just how much more they have to pay for hauling than those who have railroads, canals or good highways to traverse *en route* to market. Here it is in black and white:

Table of the force required to move one ton, at a walk, on a level road, composed of

the following surface materials, with an approximate exhibit of average cost per mile and limit of haul.

Surface.	*Force in pounds.*	*Cost in cents.*	*Value of load.*	*Distance it can be moved, miles.*
Wet clay or mud	1,000	100	Say $20	20
Sand (dry)	400	40	"	50
Hard earth	200	20	"	100
Macadam	100	10	"	200
Wood or plank	50	5	"	400
Brick pavements	25	2.5	"	800
Asphalt	15	1.5	"	1,333
Railroad	9	0.9	"	2,222
Canal	1.8	0.18	"	11,111

This is certainly a remarkable exhibit, if you will only examine it. First, you will notice how rapidly the force decreases as the surface becomes smooth and hard, till we pass from solids to liquids and from the rolling friction of metals to that of water. Every ton, therefore, has to pay tribute to the surface and if the traffie is very light it may not pay to improve the road, but it takes very little traffic to make such betterment justifiable. For example, between a wet clay and a hard earth the saving per ton-mile, is 80 cents. If it cost even $1,000 per mile to drain such a road and make it always hard, the interest on the cost at 6 per cent. would be $60 and it would take but 75 ton-loads per mile per year to make up this amount.

Between mud and macadam the saving is greater but the cost is also more. Thus if an earth road cost $500 per mile to grade and a macadam $5,500, the difference is $5,000, while the saving per ton per mile is 90 cents. It would require only 333 loads to pay the interest on this increased

cost and the expense of maintenance of the macadam road would be less while the risks and wear and tear would be almost nothing.

The amount and character of the stone required for metaling is a subject which must be left for a future meditation yet it is one of almost vital importance to the makers and users of roads.

To return to the table you will find further that the average cost in cents in moving a ton at low velocities is about one-tenth of the traction force in pounds, hence the less force required the less the cost. This is well understood by railroad managers who spend very large sums in reducing grades and curves, and in making a hard and smooth track, but we poor beasts are not even given the privilege of selecting the best paths, but must wade through the fenced-up sloughs and drag our burdens after us, whether we will or not.

The last two columns will give the thoughtful reader some idea of the relative distance a load of any given value may be carried before its value is absorbed in cost of movement, and shows, at a glance, how enormously the market range or tributary area is expanded by reducing the cost of transportation. It ought to be remembered that areas increase as the squares of their diameters and hence the available markets will increase as the squares of the number in the last column, other things being equal.

Though I do not pose as a sage beast, yet I believe that I have enough horse sense to see that from whatever standpoint you examine this road question you will be convinced that you are not just to yourself, to your stock or to your country if you fail to put your road in the best condition which the traffic will warrant, and you may be surprised to find how much easier and quicker the work will be done and how much your farm has increased in value. If you can reach the station in half the time it is just the same as if you had moved your farm half way toward the railroad, which ought to more than double its value.

Prof. Louis M. Haupt, Consulting Engineer.

THE BUILDING STONE INDUSTRY OF THE UNITED STATES.

WHEN somewhere about the middle of the eighteenth century the denizens of Quincy, Mass., fearing a premature exhaustion of their building stone supply, assembled in town meeting and voted, with all due formality and attention to legal phraseology, that no person should dig or carry off any stone on the public commons or undivided lands upon any account whatever without license, they showed an ignorance regarding their possible resources which strikes the reader of to-day as dense in the extreme. How dense, will become more apparent when I state that after more than one hundred years of almost continuous quarrying, the town of Quincy shows to-day a larger number of quarries to a given area than any other portion of the United States, and the supply is by no means as yet exhausted. The itinerant working begun upon the bowlders scattered about the Quincy commons has developed into an industry representing, the country over, an invested capital of $62,662,808, and giving direct employment to more than fifty thousand persons.

So far as is possible in the space of a single article, it is proposed to give here a brief resume of the quarry industry, and discuss with equal, or even greater brevity its future.

He who would gain an adequate idea of his country's possible resources must study her surface contours. This is especially true with the subject here under consideration, since quarrying is essentially a surface industry, and the stone utilized in any particular locality belongs to the geological formations which are there uppermost. Let us then turn to a map of the United States, and by studying its surface configuration first learn something regarding its mineral possibilities before considering to what extent these possibilities have been developed. Before so doing it may, however, be well to refresh, to a slight extent, our geological knowledge—to recall briefly the various processes by which the rocks were first formed, and the subsequent phenomena which have adapted them to our use, and rendered them accessible.

A very large proportion of all the known rocks on the surface of the earth are water deposits, *i. e.*, are the result of the slow and gradual accumulation of mud, sand and gravel in the comparatively shallow waters of seas and oceans. Just what is the relative proportion in America between the

eruptive and sedimentary rocks, it is not possible to say. It has been calculated that in Europe only about 8 per cent. of the surface rocks are of eruptive origin. That such are not still lying in approximately horizontal layers as first laid down, the latest formed at the top and the most ancient at the bottom, is the result of subsequent geological changes concerning the cause of which we have nothing to do here. Sufficient for our present purpose that they were productive of folds and faults innumerable, whereby thousands of feet in thickness of massive sediments were pushed out of their original positions, folded and crushed almost like so many thicknesses of paper, and carried, superficial and deep-seated portions alike, thousands of feet in the air or sunk to corresponding depths. The Archæan nucleus of the American continent, which extended in a V-shaped mass from Canada down into New England, afforded exposures of the oldest rocks with which we here have to do. This comparatively limited area has since been added to by an era of disturbance which, inaugurated in early primordial time, resulted in the series of gigantic wrinkles, extending from Northern New England to Central Alabama, and which involved a total thickness of some forty thousand feet of strata of all ages down to and including the Carboniferous. Accompanying or subsequent to this uplifting were injections and extravasations of igneous rocks, such as on cooling gave rise to our granites and traps, while the pressure and incident heat and chemical action converted many of the beds of fossiliferous limestones into crystalline marbles, the compact argillites into fissile slates and siliceous sands into schists and gneisses. Subsequently, and with similar results were formed the mountain ranges west of the Mississippi. But the process of adaptation to the wants of the quarrier did not end here. The fracturing and faulting of these beds, incident to their elevation, exposed to atmospheric agencies rocks formed under wholly dissimilar conditions. Such were now quite out of harmony with their surroundings and became an easy prey to the chemical action of the atmosphere and the physical agencies of heat and frost. During the thousands of years which preceded the glacial epoch and man's advent upon the globe the exposed rock masses slowly succumbed to these forces, their decomposed materials being gradually removed in solution or as debris swept by every wind and rain from mountain and plain into the valleys and from the valleys into the seas. A grand leveling process was going steadily on whereby the mountains were degraded and the valleys filled. Over the northeastern portion of the country another factor now appeared—the ice sheet of the glacial epoch. This with its wonderful transporting and eroding power cleared the higher levels of their rotten covering and transported it in the shape of clay, sand, gravel and bowlders to the southward, filling the valleys, and on its final retreat leaving it in the form of moraines, kames, horsebacks and drumlins on the land or spread out over the sea bottom.


RELIEF MAP
UNITED STATES
GULF OF MEXICO,
ATLANTIC & PACIFIC OCEANS
FROM DATA FURNISHED BY
U.S. HYDROGRAPHIC OFFICE

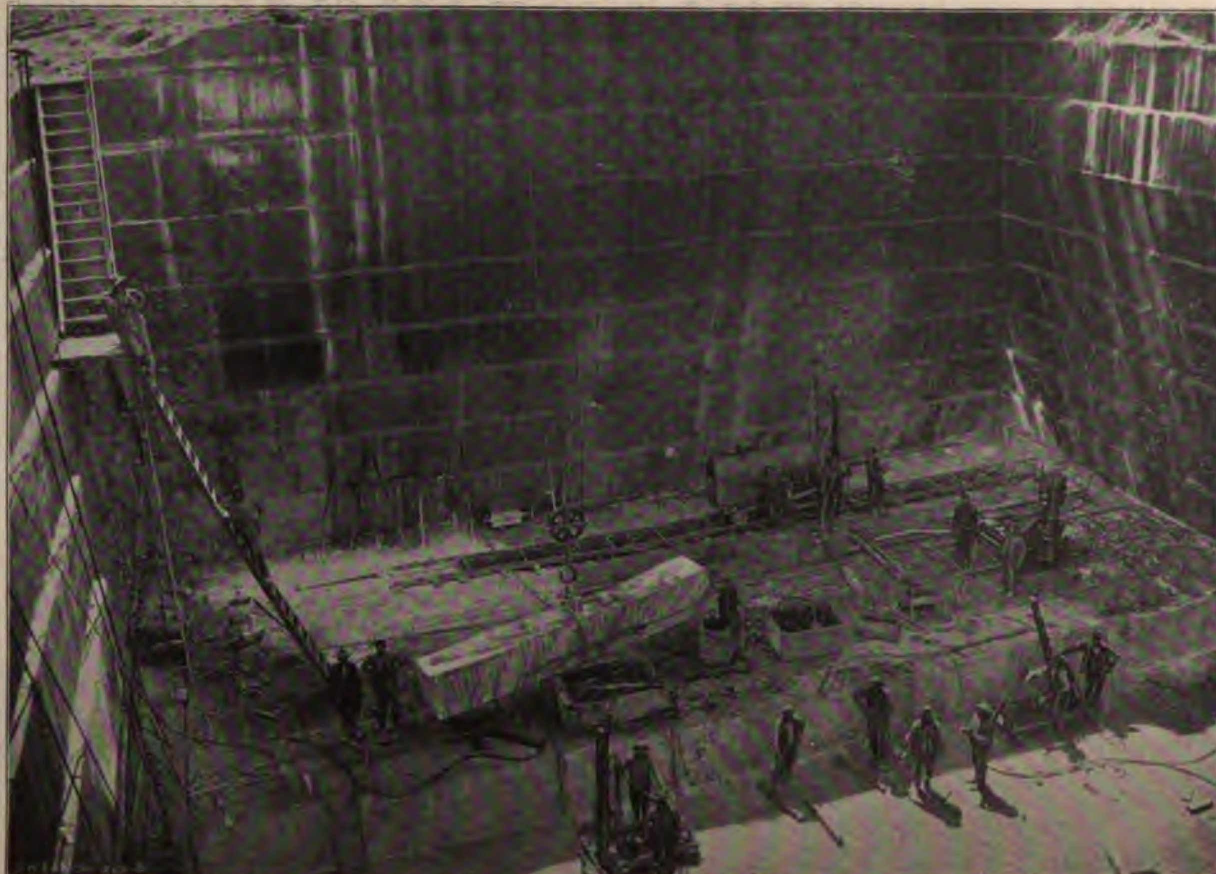
Bearing these facts in mind it requires no geological training to enable one to see that in these disturbed and eroded regions will be found a vastly greater variety of materials than in those which have retained their original horizontal position. This not necessarily because a greater variety have here been formed, but simply because they have been rendered accessible. Turning then to our map of the United States, we shall see that from northern New England to middle Alabama and with a width of from 100 to 200 miles, extends one of these areas of disturbance. Moreover the northern end of this region and as far south as central Pennsylvania has been subjected to glacial erosion, whereby a very considerable proportion of the later formed deposits have been swept away, leaving exposed the very foundations of the earth, as it were. Somewhere in this region lie exposures of rocks of every geological horizon that has here existed. There are granites and gneisses of Archæan and more recent ages. Sandstones and limestones, both marbles, and the common varieties, together with roofing slates of Cambrian and Silurian ages; sandstone and limestone of Devonian and Carboniferous ages and sandstones and traps of the Mesozoic. From the disturbed area, a thousand miles westward to the foothills of the Rocky Mountains stretches a broad expanse of plains and prairies with scarcely an elevation worthy of the name mountain, save in the comparatively limited area known as the Ozark uplift, lying south of the Missouri river where it empties into the Mississippi. Throughout the entire expanse the rocks lie nearly horizontal and unchanged as they were first laid down. The earliest formed lie deeply covered, and those now accessible are the latest formed or once deeply buried limes and sandstones which have been uncovered by erosion. South of Minneapolis we have nothing of greater geological antiquity than the Sioux Falls quartzites and little sufficiently firm for quarrying of later date than Cretaceous. There is a monotonous uniformity of limestone of the common and oolitic types, but nothing worthy the name of marble, and a similar monotony of sandstone; that is all. But with the front range of the Rocky Mountains we meet once more with a region of disturbance, and a consequent variety of material even more varied than that to the eastward.

Returning now to the Eastern and earlier settled states. In the regions traversed and bordering on the Appalachian Mountain system we find a country wonderfully rich in prospective resources, and in which, owing to its early settlement and rapid accumulation of wealth, these possibilities have to a large extent been utilized. Granitic and allied gneissic and trappean rocks are quarried to a greater or less extent in every one of the states herein included, though for reasons given elsewhere Maine and Massachusetts take the lead in this branch of the industry. The statistics given by the eleventh census show a total invested capital of all states from

Maine to Alabama of $14,102,068, yielding an annual product of some $11,742,456. This represents an increase in capital and productive power of more than 200 per cent. within the past ten years. The quality of the material produced is extremely varied in color and texture as well as quality, and might at first thought seem to include everything desirable. From the almost snow-white granites of Bethel, through the lighter grays of Barre, Concord and Hallowell to grays of the Vinalhaven, Hurricane Islands, Mt. Waldo, and other parts of the coast of Maine, the greenish grays of Cape Ann, the blue grays of Quincy to the so-called black granites (gabbros and diabases) of Addison and Tenants Harbor, there is a constant gradation. Beautiful pink and red varieties suitable for either building or monumental work occur in many instances, the more prominent localities now worked being near Calais and Jonesboro, Me.; Dedham and Milford, Mass.; Stoney Creek, Conn.; and in Jefferson county, New York.

Passing westward the next occurrence of granitic rocks occur within the glaciated areas of Northern Minnesota, where a considerable industry has been developed principally in the vicinity of Watab and East St. Cloud, the materials being coarse building granites of gray and dull red color. To the southward, in St. Francois and Iron counties, Missouri, are developments of magnificent coarse, dull red building granites which are already extensively utilized, and still farther south, in the Hot Spring region of Arkansas, occur the locally well-known "Diamond Jo" granites (elaeolite syenites.) These with the exception of local developments of a coarse redstone near Austin, Tex., are all the granitic rocks worthy of note until we reach the main range of the Rocky Mountains as it passes through Colorado and Wyoming. . The country from here westward is almost infinitely diversified and it is unsafe to say what it may bring forth. Up to date the only granitic developments worthy of note are in Colorado, Utah and California. It is unfortunate that the compilers of the eleventh census should have become so confused in their work as to give no satisfactory statistics of this branch of the industry in these regions. It can only be said that in California and Colorado in particular a rapid development has been made, and while the character of the material is in no way unique, nor different from that of the Appalachian regions, they show fine grades of gray granite well suited for all purposes to which the stone is usually applied.

As with the granite industry marble quarrying has reached its greatest development along the Appalachian chain. Each and every one of the states along this line is capable of furnishing stone of this type suitable for building, monumental or decorative work, though naturally there is a wide difference in the relative abundance and character of the materials. The earth-throws, giving rise to the green hills of Vermont, converted the calcareous muds laid down in Silurian seas into crystalline marbles of white, blue



CREOLE QUARRY, NO. 1—TATE, GA.

and gray colors which have been quarried to a gradually increasing extent since 1785, and to-day the entire output of the state is greater by some 10 or 12 per cent. than that of all the others combined. Next to Vermont, Tennessee is the leading state along this belt, the material being the well-known chocolate and pinkish fossiliferous stones from Hawkins and Knox counties in the eastern part of the state. New York, though furnishing a greater variety of material and showing a larger amount of invested capital than the last, stands but third in the list so far as value of annual product is concerned, this being due presumably to the fact that much of the stone here included under the name of marble is used mainly for building, and is valued at less per cubic foot than the purely ornamental grades. The coarse white dolomitic marbles of Westchester county, and the gray magnesian limestones of St. Lawrence county are the more important of these. The most interesting of recent developments is, however, that in Pickens and Cherokee counties, Georgia. While the census returns of ten years ago left the state an entire blank so far as marble quarrying was concerned, those of 1890 show an invested capital of nearly two and one-half million of dollars. The stone is remarkable for its coarseness and variety of colors, and is equally well adapted for general building or decorative work.

From Georgia across the wide plans of the Mississippi valley to Colorado and Arizona we must once more journey before limestones of such color and texture as to deserve the name marble are again met with. Here as yet everything is purely prospective. Materials of the highest grades are known to occur, but how they will bear development remains to be ascertained. Pitkin, Larimer and Gunnison counties in Colorado show exposures of Paleozoic limestones sufficiently metamorphosed to yield desirable materials. The "onyx" marbles of Arizona are in process of development, and beginnings have been made in Cassia county, Idaho. California alone of the states west of the Mississippi has made sufficient progress to receive attention in the eleventh census. The main points of interest are in San Bernardino, Inyo and San Luis Obispo counties, the materials being serpentinous limestone (verd-antiques), dolomites of white and clouded varieties and the so-called "onyx" marbles (travertines.)

George P. Merrill.

[TO BE CONTINUED.]

ELECTRICAL NOMENCLATURE.

THE introduction of new lines of thought, new theories, new principles and new practices, appear always to bring with them new languages or modes of expression peculiar to each and quite mystifying, not to say outlandish, to those not familiar with them. The language of practical electricity is among the class that may be marked down as the most puzzling and vexing that amateurs have ever before been compelled to wrestle with. The term volt is the one most commonly met with, as almost every reference to electricity in the daily press, or elsewhere, has something to say about volts, as for instance when a criminal is electrocuted in the state of New York, the newspapers tell how many volts they hit him with, which forthwith sets the reader to wondering what is meant. We might explain this way. Suppose we had a body of water one foot deep, to the bottom of which we attach a hose, with a three-fourths nozzle, and play the stream on a man at a distance of say four feet. He would, of course, know that he was getting doused with a stream of water, but it would have no other effect. In this case we would be hitting him with what we will call one volt of water, but he would not mind it a bit, as he would scarcely know he was being hit. But suppose we change the hose from the one foot head of water to one of 200 feet in height and let loose on our imaginary criminal. This time we hit him with 200 volts instead of one as before, and if conscious at all, he is conscious that something has hit him and hit him hard.

An electrical volt, therefore, means the measure of weight or pressure. The greater the number of volts the greater the pressure and the greater the force with which an electrical current strikes; 200 volts is not a very strong electrical current as 1,700 or more volts are used at electrocutions, according to the newspapers. The reason of it is that such [a small current of electricity is used the work must be done under great pressure. Now if we were to reduce the size of the nozzle to that of the electrical wire, we would have to get the hose under a head of 2,000 feet or upward to have the same effect as the three-fourths stream under 200 feet head. So small a jet of water under such a pressure might have no effect as it would probably fly into spray, but it serves to illustrate just the same.

The ampere is the next electrical term most commonly met with, and means a measure of quantity. Thus, for instance, if we cut an orifice of one foot square in a penstock to furnish water to the wheel, we give it one ampere of water. If we make the orifice two feet square we give the wheel four amperes of water, and if it is made four feet square we furnish sixteen amperes of water and so on; no changes having been made in the height of the head.

Now then, as will be readily understood from what has already been said,

if we have a head of water one foot in height, and an opening one foot square leading to the wheel, we will say for illustration, that we have supplied the wheel with one volt and one ampere of energy. If the opening is made one foot deep and two feet wide, one volt and two amperes of energy are supplied. If four feet wide then one volt and four amperes are supplied. If we raise the head to four feet and leave the opening one foot square, four volts and two amperes of force are furnished. If head is raised to sixteen feet then we have sixteen volts and four amperes of force. If the opening be made two feet square, there will be sixteen volts and sixteen amperes of force. These comparisons will be best understood when it is stated that as the height of a head of water is quadrupled the flow of the water is doubled, thus a head of sixteen feet will discharge twice the quantity of water that an eight-foot head will through the same sized opening. To ascertain the aggregate energy of a stream of water flowing from a penstock to a wheel, we multiply the quantity by the height or pressure. In the same way to ascertain the aggregate force of a current of electricity we multiply the number of volts by the number of amperes. There are other mystifying electrical terms in use, but to avoid confusion and nausea, it is best to take electrical lessons in homeopathic doses.

RAPIDITY OF MODERN BUILDING.

AS an illustration of the rapidity with which the work of erecting the exposition buildings is being pushed ar Jackson park it may be stated that on March 1, sketches were made for a building to serve as permanent accomodations for the Construction Bureau, the Columbian guards, emergency hospital, central fire alarm service, etc. The contract was let on April 2, and on April 30, the building was finished and occupied. The structure measures 200 by 300 feet, is covered and ornamented with staff, and is substantially put up.

CEMENT FOR REPAIRING STONE.

TO prevent sandstone from crumbling away, a quality peculiar to Ohio sandstone, in some exposed places, a wash is recommended made of plaster of paris colored with any dried paints to a suitable color, then quickly wet to a paint and applied, where not exposed to the weather. To repair corners a cement made as follows is recommended: Dry, clean, fine sand twenty parts, litharge two parts, pulverized lime one part. Mix with boiled linseed oil to a thick paste.

c—*Stone.*

THE HENNESSY MONUMENT.

THE monument to David C. Hennessy, illustrated on the opposite page, was unveiled in the Metairie Cemetery at New Orleans, on May 29.

The memorial is among the last of the series of incidents growing out of the Mafia Vendetta League in that city that culminated in the death of Mr. Hennessy, the summary slaughter of a few of the assassins, and the complications with Italy that grew out of it. For these reasons the monument will always retain an interest to the whole people, and locally memorialize the reign of terror that was finally strangled through the efforts of the deceased.

The monument is of Holloway granite, 26 feet high, and stands on a mound four feet high. The base of the shaft is seven feet six inches square. The die of the monument is highly polished. On the side facing the main avenue appears the coat of arms of Louisiana, and on the four sides are the following inscriptions:

FRONT OF TOMB—David C. Hennessy. His life was honorable and brave. His fidelity to duty was sealed with his death.

RIGHT SIDE OF TOMB—Erected by his countrymen, May 29, 1892.

REAR OF TOMB—Mortally wounded by assassins, Oct. 15, 1890. Died Oct. 16, 1890.

LEFT OF TOMB—Superintendent of New Orleans city police from May 2, 1888, to Oct. 16, 1890. Born in New Orleans.

The shaft is surmounted by a pall or mantle and a police belt and baton exquisitely sculptured. Four beautiful marble vases, three feet high, are placed one at each corner of the mound, the gift of Ex-Mayor Shakspeare.

It is one of the handsomest monuments in New Orleans, and was designed and erected by Mr. Albert Weiblen, of New Orleans, who received the contract on December 28, 1891.

David C. Hennessy was born in New Orleans on March 4, 1857, and was in his 34th year at the time he was assassinated. He was appointed messenger in 1870 by General A. S. Badger, who was then in command of the Metropolitan police. He, gradually arose from that position until he was appointed detective. He was afterward placed in charge of Farrel's police, and was superintendent of that force during the world's fair held in New Orleans in 1884-85, where he demonstrated his ability by capturing several offenders, who committed depredations in the several buildings of the exposition. He was appointed chief of police by Mayor Shakspeare in April, 1888, and was elected superintendent of police when the police board was placed in power. His death occurred on Oct. 16, 1890, from the effects of wounds inflicted by members of the Mafia on the night previous, while on his way home, at the corner of Girod and Basin streets.


HENNESSY.

ARE THEY STONE COINS?

IN cutting a great sewer through the glacial drift on which the city of Brooklyn stands, the workings in some cases being carried down for nearly 2000 feet, a number of curiously marked stones were discovered that, in the opinion of Francis Worcester Doughty, are archæological implements and coins. Objects bearing undoubted marks of human workmanship have been taken from drift before, stone-tools and weapons having beed found in Ohio, and a well carved statuette in Idaho, but nothing before has been seen that would pass for a coin. If the claims are well founded, it will set back by some thousand of years the attainment of relative civilization in America, and will confirm the gathering proofs of immense longevity for the human race. The objects found in Brooklyn include purple slate, carved in the form of the human head and of various animals, both existing and prehistoric types; also objects made of cast iron. One of these represented a deer's head, remarkably perfect, and had a horn welded in the proper place. There were also exhibited at Mr. Doughty's lecture a number of curiously-shaped tablets, some of baked clay, carved and painted; others of a mixture of iron and clay (clay-iron stone), and one large one, covered on one side with a substance like parchment, and painted. On all these tablets were pictures representing various scenes, together with certain marks, which the speaker predicted would be ultimately determined to the either hieroglyphics or inscriptions in some heretofore unrecognized language. One carved plate of ordinary brownstone was shown, taken from the drift at Bay Ridge, which bore the figure of a bearded man, with arms amputated. The collector says that some of the heads exhibited were manifestly those of Indians, others bore strongly-marked Circassian features and were bearded. One was startling in its resemblance to Assyrian portraiture, and others followed the cranial outlines of heads depictured on the monuments of the ruined cities of Palenxue and Uxmal in Mexico and Yucatan. Photographs of recognized prehistoric stone implements were also exhibited, taken from various depths in the drift. The most important part of the address was that which went to show the comparative relation between the objects discovered and the oldest known coins. As is understood by numismatist, the earliest coins of the world bear symbolic representations of human or animal forms, constituting the totems, or tribal marks, of the communities which issued them. The most rncient of these marks is the colossal human head, represented both singly, as the Sphinx, and double, as the Janus. On all specimens taken from the drift, excepting the tools, the speaker said that the human head is to be found depicted in one or another

of these forms. A carved stone, representing a colossal head in profile with a pyramid alongside of it, was exhibited, also a smaller specimen of the same kind. A large line of ancient Roman and other coins was shown, all having cuttings in the edge of the planchets, which it was claimed, were not mere accieents, but intended to represent the human mouth, with small holes bored in proper relative positions for eyes, the whole making a representation of the human profile, following the symbolic idea on the objects taken from deep deposits of drift. Attention was called to the existence on the earliest coins of Rome of the same markings as those on objects taken from the drift. These markings have never been described, having heretofore been believed to be of accidental occurance. While not hazarding the statement that they have a lingual significance, the speaker believed that such was the case, and called attention to the fact that many specimens on which they occur were as perfect as on the day of mintage, which precluds the possibility of their being the result of corrosion.

WATER REQUIRED TO PRODUCE A HORSE POWER.

THE wildest ideas often prevail concerning the amount of water required to produce a horse power, writes Robert Grimshaw. The trouble is that some people consider that height of fall is the only thing to be considered; others that amount of water is the sole element; whereas, as the matter of fact, both are equal factors. To give some idea of the amount of water that is needed to produce one theoretical horse power, a fall of one foot is assumed; and it may be mentioned incidentally that the weight of water is 62⅓ (not 62½) pounds per cubic foot, or 8⅓ pounds per gallon. This being the case, and bearing in mind that it takes as a minimum to produce one horse power, 33,000 pounds of water every minute falling a foot high, this is equivalent to a minimum of 3,960 gallons, or 513.64 cubic feet per minute, falling that foot high; 513.64 cubic feet or 3,960 gallons would be contained in a box eight feet on a side, internal dimensions. If the fall were five feet instead of one, there would be needed per minute only 792 gallons or 102.73 cubic feet, which would be held by a cubical box 4.69 feet on the side, internal measurement.

A MODEL DISTRICT ASSOCIATION.

WORTHY of emulation by quarry-owners in other districts is the Joint Quarry-Owners' Association of Southern Ohio, comprising all stone districts within a radius of sixty-five miles of Portsmouth, O., and embracing in its entirety the freestone district described elsewhere. The following declaration issued by the association sets forth plainly the intents and purposes of the organization:

"The object of this association shall be to foster, protect and promote the welfare and interests of its members; to inculcate just and equitable principles of trade, to acquire and disseminate information to the quarrying industry of this district, and provide a mode of harmonious action in adjusting differences between members and their customers as far as possible, and settle disputes between members."

A. CADEN, PRES.

One of the objects sought for in this organization is a uniformity of prices and one of the rules of the association is that, "The market value shall be considered and established in each district on a basis of delivery to the nearest common carrier, and adjusted from time to time, as the association may see proper, or deem best for the advancement and general welfare of the business. When to be delivered to any point beyond the nearest practicable means of transportation, and in the absence of a contract with the association, the actual cost of freights is added to the price, and such per cent. additional as may be proper for the risks assumed."

IGNATIUS REITZ, V. P.

Another rule which in the opinion of the average stone dealer will be honored more in the breach than in the observance, reads as follows: "In nowise shall the members of this association reflect discredit upon the merits or quality of each other's stone, except before a meeting of this association. Neither shall they in selling stone in opposition to each other, deviate from the established prices; but when selling in opposition to stone quarried outside of this territory, or by non-members, they shall be guilty of no offense for either advancing or reducing the price, provided they duly notify the secretary of

this association, giving particulars, within three days from time of such action."

The principles last mentioned are religiously observed, the only breaches thus far occurring having resulted more from ignorance of necessary procedure, than from a willful attempt to evade the by-laws. A communication recently received from the secretary contains the encouraging information, that the June meeting was perfectly harmonious and left nothing to be desired.

W. R. SMITH, JR., SEC.

If the quarry-owners of one district can lay aside all petty grievances and let up on the "dog-eat-dog" principle, it seems as if those in other districts should do as well, for therein lies the solution of the great problem confronting producers of stone to-day. District organizations first, and then a national association whose meetings shall be attended by delegates from the district organizations, will go a long way toward remedying evils patent to those in the trade. It is a "condition" not a "theory" that confronts them.

ROCKS AT THE WORLD'S FAIR.

MARBLES, agates, jaspers, onyx, silicified wood, etc., will be offered for the inspection of the architect and decorator. Numerous machines and tools for channeling, sawing, lifting, turning and polishing granites, sandstone, marble, etc., will be collected for the purpose of demonstrating the facility with which great masses of stone are transformed into useful and ornamental objects and made suitable for the most skilled handicraft. Sands for the manufacture of glass, many colored clays, and kaolin of all grades for the potter, brickmaker, porcelain worker, etc., polishing substances, whetstones, hones and emeries, will constitute a group of unusual interest to both the student and manufacturer. Asphaltic and cement mixtures and artificial stones, which have made the pavements of Paris and the capital of our own country superb in their cleanliness and the admiration of the world, will be illustrated in all their multifarious uses.

JOHN MILLER, TREAS.

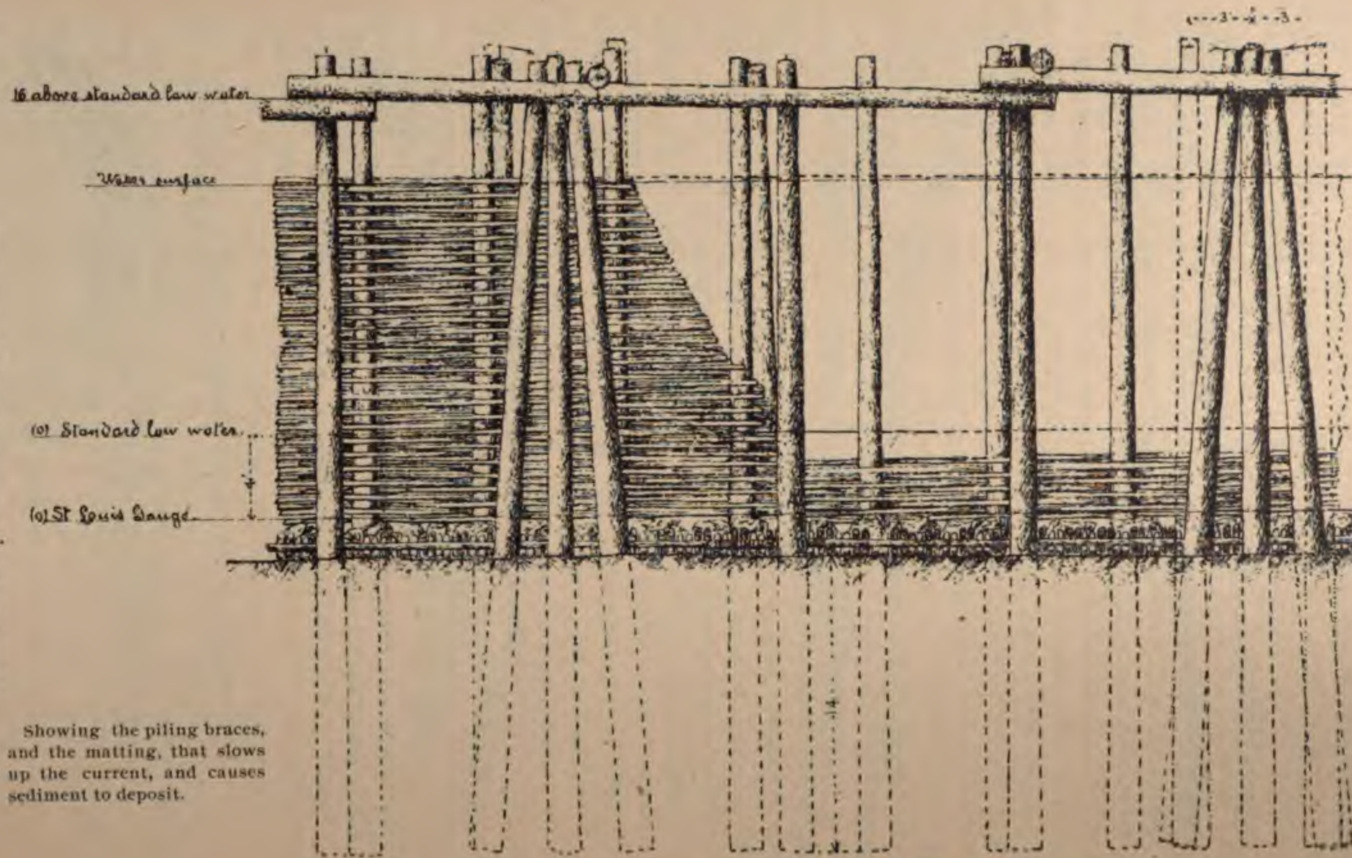
MISSISSIPPI RIVER IMPROVEMENT.

THE growing demand in the West for a national policy of improvement of our interior navigation, and the increasing liberality of Congress, in its appropriations for this object, are, in themselves, an interesting indication of a national vigor which neglects outside and international questions to devote itself to that vast and mighty task of interior development which presents nowhere else on the globe such strange exhibitions as in the United States. The seven-fold increase of the population and the doubling of the number of states, within the memory of persons still living; the admission of six new states between February 1889 and July 1890; the construction of 5,000 to 10,000 miles of railway every year accompanied by the spanning of wide and rapid rivers with bridges 1,000 to 5,000 feet in length, and the opening up of the treasure deposits in the Rocky Mountains, are some of the products of this development, and the growth of our domestic interchange to an estimative value of 30 billion dollars, is part of what we have to show for our work. The time will come when we will take a larger part in the course of affairs outside our own boundaries; indeed, the meeting of a Pan-American conference at Washington, the formal incorporation of reciprocity with the Spanish-American countries south of us into our foreign commercial relations, and the commencement of the work of constructing a ship canal through Nicaragua by an American company, are indications that the time, if not already here, is close at hand. But there is no other country in the world whose people have so much to do at home, as ours, and although much has been accomplished in the last three-score of years, so much yet remains to be accomplished that our domestic policies must continue to dwarf our foreign policies for a score of years to come.

It is not surprising that the question of transportation occupies so important a position in our schedule of domestic economies—for, in addition to the enormous amount of individual traveling we do, it is twenty-five degrees of latitude from our northern to our southern boundary, and forty

degrees of longitude measured across the country from the Atlantic to the Pacific ocean; and the great variety of products yielded by the area inclosed within these vast limits demands an interchange traffic of prodigious proportions. We have in the Mississippi Valley alone 15,000 miles of navigable water-way, which we have reinforced with over 100,000 miles of railway—and yet, a good crop of grain in the West, together with a large crop of cotton in the Southwest, reminds us that our transporting system is still deficient, since millions of tons of farm produce must wait for weeks and months before it can be carried to market. It is a matter of no greater importance to farm products that they shall have access to markets than that they shall be carried at low rates—for, while the freight charge on a ton of manufactures worth $500 to $5,000 is a very small percentage on its value, the freight charge on a ton of farm produce worth only $50 to $250 is a very large proportion of its value; and when it is considered that 42,000,000 of the 52,807,000 bushels of wheat raised in Indiana last year; 48,000,000 of the 55,000,000 bushels raised in Minnesota; 47,800,000 of the 54,800,000 bushels raised in Kansas; 78,000,000 of the 81,000,000 bushels raised in the two Dakotas, and smaller proportions of the crop raised in the other agricultural states of the Central West, together with 1,000,000,000 bushels of corn, either in the form of grain or converted into live animals, meats and dairy products—that all this mass of cheap and bulky freights has to be carried 800 to 2,000 miles to points of consumption and exportation in the Atlantic states, it is not strange that the question of carrying rates should have become one of such intense concern in the West, and that arbitrary legislation should sometimes be resorted to in the attempt to solve it.

But there is no need for a resort to violent legislation, nor direct legislation of any kind, to secure cheap freight rates for the farm products of the West. The object can be attained more effectually in an indirect way—by an improvement of the 15,000 miles of natural navigable waterways of the Mississippi Valley. Water carriage is cheaper than rail carriage—indeed, it is the cheapest of all methods of transportation; and the more safe and easy water carriage is made for large cargoes in a single vessel, or tow, the nearer transportation is brought to the ideal minimum of cost. Recognizing this economic fact, and making it the starting point of a wise and benign policy for a reduction of freight charges on the internal traffic of the country, the government has selected the great parent river of the Central West as a subject for systematic improvements, which shall afterward be extended to its affluents in twenty-two states. A large part of the commerce of these states flows naturally into the parent stream, and the benefits of an improvement would reach even that portion of their commerce which moves in other directions by rail—for there is no phenomenon in



Showing the piling braces, and the matting, that slows up the current, and causes sediment to deposit.

Up-stream view of finished Hurdle.

transportation which observant railroad men themselves are more prompt to discern and admit than the effect of a navigable waterway, river, or canal, in cheapening carrying rates by rail as well as by water, and on lines perpendicular as well as parallel to the railway lines of transit.

In a good stage of water, freight is carried on the Ohio and Mississippi rivers at a charge of $3 a ton for a distance of 1,200 miles, while the average rate by rail on all the roads in the United States for 1890 was .941 of a cent per mile per ton, or $11.28 for 1,200 miles; and if a general and thorough improvement of the interior waterways should cheapen by only one-fourth the carrying charges on the 250,000,000 tons of freight moved in, into and from the Mississippi Valley every year, the saving would pay the cost of securing it twice over every year. It may be said, then, that a government which finds its reason of existence and maintenance in the well-being of the people cannot find a better subject to exercise its functions upon than the task urged alike by national and economic considerations of encouraging intercommunication between its people by increasing the capacity of the natural agencies of such intercommunication. It could construct railways of its own to compete with the like agencies owned and operated by private corporations; but this would bring it in business conflicts with its own citizens and expose it to the complaint of invading a field hitherto left to individual enterprise and effort. The navigable rivers of the country are its own, or rather, the property of the people, and not only may it facilitate and cheapen the navigation of them and thereby secure something like an imperial authority over the carrying charges on its vast internal traffic, and use it for the welfare of the people, but it can do this at a cost much smaller than that of a system of imperial railways. If there are reefs and snags in a river which obstruct the movement of vessels, the government is well engaged in removing them. If there are shoals, over which vessels cannot pass with full cargoes, it may dredge and deepen them. If, in places, the water is spread over too wide surface, it may compress it within a smaller area. If, in other places, the current impinges so strongly against the bank as to eat it away, causing the river to move in that direction, it may arrest the movement by revetments which present a rock-facing for the stream to exhaust its gnawing habit upon. In prosecuting this task it has divided the Mississippi into three sections—the first extending from the Falls of St. Anthony to the mouth of the Illinois, a distance of 768 miles; the second extending from the mouth of the Illinois to the mouth of the Ohio, a distance of 232 miles; and the third extending from the mouth of the Ohio to the Gulf, a distance of 1,152 miles. The upper section is in charge of Major A. Mackenzie, Corps of Engineers, U. S. A., stationed at Rock Island; the middle section in charge of Major A. M. Miller, stationed at St. Louis, and the lower section is in charge of the Mississippi River

FIG. 1.

FIG. 2.

Figures 1 and 2 show the river from Calico Island to Sulphur Springs. Fig. 1 being the river as it was in 1889, and Fig. 2 as in 1891 Comparisons will show the deposition of detritus caused by the hurdles, where the bars from the channel have been thrown against the shores. Figures 3 and 4 show the river from Pulltight to Horsetail; Fig. 3 as it was in 1889, and Fig. 4 as in 1891.

FIG. 3.

FIG. 4.

Commission, with Capt. Palfrey stationed at St. Louis as secretary and executive officer.

The object of improvement work, as briefly stated by Major Miller, is to obtain a minimum depth at low water of six feet from the mouth of the Illinois river to St. Louis, a distance of 41 miles, and eight feet from St. Louis to the mouth of the Ohio, a distance of 191 miles, the natural depth at low water being in many cases from 3½ to 4 feet, and the plan of improvement contemplates a reduction of the river to an approximate width of 2,500 feet below St. Louis, the natural width being in many cases from 1 to 1½ miles, and the protection of the alluvial banks from erosion. The river itself is made to do its part, and the chief part, in this work, which consists in building up new banks with solid matter taken from the stream by means of hurdles and revetments. It is sometimes disparagingly asserted that the great rivers of the Central West are addicted to the bad habit of drying up in the summer, and becoming worthless. But the truth is, that, even in the seasons of lowest water, there is an ample supply of water in the Mississippi from St. Paul to New Orleans, and in the Ohio from Pittsburg to Cairo, for purposes of easy and safe navigation, if, instead of being spread over the wide natural area, it were contracted within narrower channels. One-half, sometimes three-fourths of the water, lies behind and around sand-bars in a semi-stagnant condition, and useless. If it can be prevented from wandering into these places, and forced to flow in a plain, unobstructed channel, the stream will do its own dredging, or a large part of it, scouring its bottom, removing bars, and affording a sufficient depth of water for navigation, even in the lowest stages, and the government engineers report that wherever, even in the most difficult places, the appropriations by Congress have been liberal enough to permit them to complete an improvement by continuous work, a permanent deepening has been effected. The bars at Horse Tail, Pulltight, Jim Smith's and Turn Hollows, a short distance below St. Louis, over which the water, in low seasons, formerly shrunk to a depth of 4½ feet, and which offered harassing obstructions to the vast river traffic between that city and the South, have been cut away until there is now a stage of six to eight feet on them in the low season, and at several points on the upper section of the river, between St. Paul and Keokuk, shoals have been deepened from two feet to four, and from three feet to five.

The Upper Mississippi from the mouth of the Missouri to the Falls of St. Anthony is so different from the lower part of the stream from the mouth of the Missouri to the Gulf, that the lower section is more like the Missouri than the upper section of the Mississippi, and there is no small show of warrant for the claim that it is the Missouri river, not the Mississippi, that flows to the Gulf, and the Mississippi that empties into the Mis-

souri 21 miles above St. Louis. The difference requires a radical difference of treatment in the engineering constructions for controlling the current. There is little solid matter carried in the upper river and it is not subject to the enormous floods that constitute a regular annual phenomenon in the Lower Mississippi. The obstructions above the mouth of the Missouri consist of sand-bars which, in the low season, widen out so as to occupy half the river area, and make the channel tortuous and difficult to follow. The usual treatment is to construct dams above the shoal places so as to throw nearly the entire body of water into a channel of about 1,800 feet wide. These dams built of rock or mattress work are laid without difficulty when the river is low, and, having no great floods to encounter, are seldom broken. The banks are not subject to the destructive erosion which is one of the incorrigible habits of both the Missouri and the Lower Mississippi, and revetments are therefore rarely necessary. The chief part of Upper Mississippi tonnage consists of lumber tows and rafts which float with the current, and the lumbermen declare that the worst dangers they have to meet are not the natural impediments of reefs and bars, but the artificial ones of railroad bridges against whose frequent piers their tows and rafts are in peril of going to pieces. These obstructions are so formidable that it is frequently necessary for the towing steamer to go to the bank above a bridge, divide her tow in two or three parts, and take one through the opening at a time—a process which causes considerable delay and expense, when it is considered that there are five or six bridges to be encountered. One of the most important improvement works on the Upper Mississippi was required at the mouth of the Des Moines, where a stretch of rapids 12 miles in length presented a most annoying obstruction to navigation. The plan decided on provided for the building of a closed canal eight miles long, and the cutting of an open channel in the rock bed of the river over the remaining four miles of rapids. This canal was begun in 1866 and opened in 1877, the cost of the work having been $4,538,000 to 1890. The report of Mayor Mackenzie shows that the canal was open for navigation during the year 1890, 234 days, in which time there passed through it 878 steamers and 357 barges, carrying 15,801 passengers, 45,217 tons of merchandise, and 364,878 bushels of grain, and in addition to this, 193,000,000 feet of luuber, 37,000,000 feet of logs, 87,000,000 shingles and 59,000,000 laths.

Below the mouth of the Missouri, the improvement work consists of revetment of the alluvial banks to protect them from erosion, and dykes, hurdles and mattresses for the contraction of the channel to one-half its natural width. The revetment is effected by weaving mattresses of willows on the deck of a mat boat, laying them along the bank where the current sets against it, and covering them with rock. When this work is well done, it is generally permanent and effectual. The dykes for narrowing the chan-

nel are made of piles driven in rows from the bank into the river and in lines perpendicular to the channel. These are driven or sunk into the bed of the river to a safe depth, and additionally secured by a foundation of mattress work laid round them and loaded with rock. The spaces between the piles are filled with willow matting, the object being to arrest the solid matter in the stream, and cause it to precipitate, and thus gradually build up a new bank. This solid matter is so great in quantity that sometimes the new bank is built in three years, the river itself doing the larger part of the task, and furnishing the material for its enthrallment. In many cases, large and valuable areas of very productive land are made between the new bank and the old one, which, by the law of riparian rights, go to the owners of the adjoining property.

As an accessory to the work of permanent improvement, dredge boats and snag boats are constantly patrolling the river, in the low water season, deepening the channel where it is temporarily clogged with deposits of sand mud, pulling out snags from the bottom of the river, cutting down leaning trees on the bank, and breaking up the drift piles, lodged around bars and other obstructions. How important this business is may be inferred from Mayor Miller's statement that there were 3,450 snags pulled out, 21,316 trees cut, and 37 drift piles removed between August, 1890, and March, 1891; and how valuable it is will be understood when it is stated that the sinking of vessels by striking snags made fast in the bed of the river, once a frequent occurrence, is now seldom heard of.

D. M. Grissom, C. E.

MECHANICAL AND POTENTIAL ENERGY.

MECHANICAL energy is the capacity of any element that may be used for performing useful work under certain conditions. This may be considered under two heads: first, the actual energy that the element may possess; and second, the net amount that may be realized from it. Thus a cubic foot of water may possess an energy equal to 62½ pounds, but in order to realize power from the same certain conditions must be complied with, and then. not all that energy under any condition can be realized; and the net amount of useful effect that may be realized is sometimes termed the potential energy. Thus a weight of 100 pounds may be said to possess an energy equal to that amount, but the potential energy that may be derived from it will depend entirely upon the distance through which it is moved. A weight of 100 pounds resting upon the earth has no available power, yet if the same be elevated a certain distance from the earth and allowed to descend, its mechanical energy is equal to the product of its weight into the distance through which it moves, and its potential energy or net power is less than the mechanical by whatever resistance is offered in its application. If the weight of 100 pounds be elevated 50 feet, then it possesses a mechanical energy equal to $50 \times 100 = 5{,}000$ foot pounds, but should there be a loss in friction or otherwise of 100 pounds, then the potential energy would only be equal to $5{,}000 - 100 = 4{,}500$ foot pounds.

The same is true with water. Take for example a reservoir containing 1,000,000 cubic feet of water, situated at an elevation of 100 feet from its center of gravity, to the point where it falls. Now, as one cubic foot of water weighs 62½ pounds, it is evident that the whole mechanical energy of that amount of water is equal to $62.5 \times 1{,}000{,}000 = 62{,}500{,}000$ foot pounds, and it makes no difference whether the whole is applied in one hour or one day the mechanical energy in the aggregate is the same. But if the water in descending meets with resistance either by the friction in the pipe or conduit through which it passes, or is applied in any manner for operating machinery by any motor that will only return in useful effect 80 per cent. of the mechanical energy, then the potential energy will be reduced to 80 per cent. of the mechanical. Hence the necessity where a given amount of water is required to be delivered through long conduits in a given time of providing sufficient area to avoid unnecessary loss by friction, for it must

be remembered that the smaller the conduit the greater the velocity of the water, and the greater the velocity of the water the greater the loss by friction. While it has been shown that the quantity of water discharged in equal times under the same head, through different sized apertures in a thin plate or pipe, not exceeding two or three diameters of the aperture in length are to each other as their areas, the same is not true where the discharge is through pipes or conduits of greater length. Thus, if an aperture in the bottom of a reservoir one-inch square will discharge 20 cubic feet of water per minute, another containing an area equal to two square inches under the same head, will discharge 40 cubic feet of water in the same time and under the same conditions. Again, the quantity of water discharged in equal times by the same sized aperture, under different heads is in proportion to the square roots of the corresponding heights. Therefore, if the discharge of water through an aperture of one square inch, under four feet head be 6.68 cubic feet per minute, the same sized opening under nine feet head will discharge a quantity in proportion to the square of their respective heads. Now, the square root of four is two and the square root of nine is three. Hence, 2:3::6.68:10.02 cubic feet.

The same is true with the spouting velocity or the force with which it is discharged, which is generally computed in feet per second, and if the spouting velocity under four feet head is found to be 16.04 feet per second, then the same velocity under 16 feet head would be 2:4::16.04:32.08 feet per second. While it has been found, that in horizontal tubes, not exceeding three or four diameters of the aperture, the discharge is sensibly increased, beyond that length it begins to decrease, and the greater the length of the pipe or conduit, the diameter being the same, the greater the diminution of the discharge, and that the disharges made in equal times by horizontal pipes, of different lengths and of the same diameter, under the same head, are to each other in the inverse ratio of the square root of their length.

Now, as the theoretical discharge is to the real as 1.63, it follows that all pipes and conduits should be large enough to compensate for this difference. For while we found that a conduit of not more than from three to four inches diameter in length, will discharge under four-foot head 6.68 cubic feet of water per minute, for each square inch of sectional area, yet the real discharge is not over 63 per cent., or about 4.20 cubic feet. Therefore, in the construction of conduits of different lengths, the sectional area should always be calculated from the real quantity of water discharged, and the potential energy that may be obtained will depend upon the manner in which it is applied, but with the best wheels it is doubtful whether over 80 per cent. is obtained. But the same laws that apply to horizontal conduits cannot be applied to those which are perpendicular or nearly so, for while the quantity of water discharged by the former decreases as the

length increases, the discharge from the latter increases as the length and the quantity of water discharged through conduits that are perpendicular, or nearly so, with the same diameters, but of different lengths, are in proportion as the square root of their lengths.

The steam engine and boiler is another practical illustration of mechanical and potential energy. The boiler may contain a mechanical or stored energy equal to a pressure of 60 pounds to the square inch, but if the manner in which the steam is conducted to the engine is such that the pressure in the cylinder is reduced to 50 pounds, then the potential energy is reduced to that amount, and if by friction or other cause that energy is further reduced then the whole potential energy of the boiler amounts to no more than the actual power that is transmitted to the machinery, and while the whole mechanical energy in the boiler may be estimated at 60 horse power yet not more than one-half or two-thirds of that power may be had in potential energy or useful effect. Although the discharge of steam through pipes is not governed by the same laws as water, yet the loss by friction and consequent loss in pressure by conducting it through long pipes of small diameter is very similar, and while the friction of steam is less than water, owing to its less density, yet with pipes of the same diameter and length the friction is directly in proportion to its density. Hence, it is quite as important that the pipes which conduct the steam from the boiler to the engine should be sufficiently large to avoid friction and loss, as those of the conduit to conduct the water to the wheel.

C. R. Tompkins, M. E.

PRACTICAL DISCOVERIES IN MOLECULAR PHYSICS.

WITHIN the two years past an entirely original investigator in electrical fields, Mr. Nicola Teslà, has made discoveries that are startling in their significance of great powers, that as foreshadowed will soon be harnessed to the work of man. His experiments have already demonstrated that light without heat only remains as a mechanical problem. W. E. C. Gordon, in the *Nineteenth Century*, reviews the work of Mr. Tesla, and also gives such explanations of phenomena as to make it understood in the popular sense.

Mr. Tesla is a young electrician, born at Rieka, on the border of Montenegro, but for a couple of years has been a resident of this country. His researches not only include the relations between light and electricity, but between matter and motion:

The tendency of modern science is to remove day by day the barriers between its branches. Our views of the phenomena of light and heat, of electricity and magnetism, and even of matter and motion, are rapidly merging into one general theory of molecular physics, which is perhaps best expressed by the vortex theory of Sir William Thomson.

According to this theory, the whole of every part of space is filled with a fluid called ether, almost infinitely elastic. The historic experiments of Faraday, interpreted by the mathematical researches of Clerk Maxwell, have demonstrated almost beyond doubt that the same ether whose waves carry light and heat from the sun and stars to the earth also carries the waves of electric and magnetic induction which, as the daily experiments at Kew Observatory show, follow each outburst of solar activity.

Sir William Thomson holds that all that which we know as matter consists of vortices or whirlpools of this ether, which, from their rapid rotating motion, resist displacement, and therefore show the common properties of hardness and strength in the same way as a spinning top or gyroscope tends to keep its axis in a fixed direction. But whether the molecules or particles of what we know as matter are independent matter, or whether they are ether whirlpools, we know that they keep up an incessant hammering one on another and thus on everything in space.

Professor Crooks has shown that the forces contained in this bombardment are immensely greater than any forces we have yet handled, many millions of horse-power being contained in an ordinary room. Owing, however, to the forces being in every possible direction they neutralize

each other, and no result of them is perceivable to our senses; but if ever we discover how to so direct their courses as to send the majority of them in the same direction, we shall have at our disposal forces as much exceeding any we are now acquainted with as the blow struck by bullet exceeds the force required to pull the trigger of a gun. In fact, as Mr. Tesla put it in his lecture, "We shall then hook our machinery on to the machinery of nature." It is because they hold out to us a hope, however distant, of some day so guiding the ether storm, that the experiments of Nikola Tesla are of such transcendent interest and importance.

Professor Crookes, in his experiments on "radiant matter," has given us the first hint of a method of directing what, for want of more exact knowledge, we will call the molecules of matter. With the appliances at his command, however, he was unable to impart any great change of direction, but he succeeded in making that change manifest by reducing the disturbing forces acting against his directing force. In other words, he pumped out from glass bulbs and tubes nearly all the air or other gas that they contained, and the comparatively few particles left were then free to travel in any course imparted to them without much change caused by collision with others. This special direction was imparted by means of electricity, and gave us the beautiful phosphorescence and radiant matter, which are now so well-known in these experiments.

By means of suitably shaped terminals a stream of molecules is focused on a given point. If a piece of carbon or platinum is placed at that point, it becomes white hot under the bombardment from identically the same cause which causes a sheet of flame to appear when a cannon shot strikes an iron target. If a ruby or other phosphorescent material is placed there, it glows with its characteristic color, and if a little delicately balanced vane or windmill is placed on one side of its fans it rapidly revolves. The forces available in these experiments were, however, almost indefinitely small, being, as it were, merely flying spray from the great torrent into which we have not yet been able to penetrate.

We now come to the advances made by Mr. Tesla.

In all the above experiments the electricity by which the directing force was imparted to the molecules was electricity of a comparatively slow alternation period—namely, electric currents oscillating about 80 to 100 times per second. It was as if we had tried to ventilate a room by causing a man to walk slowly through it with an umbrella. He would undoubtedly move the air, but would move it so slowly that ordinary methods would be insufficient to enable us to perceive its motion. In order to cause a rush of air we must put a rapidly moving fan or other suitable machinery. Mr. Tesla seeing this, abandoned the ordinary dynamo, which, as we have already noted, gives about 80 alternations per second, and the ordinary induction coil, which

gives about the same number, and boldly constructed a dynamo which gives 20,000 alternations per second, and by connecting this to suitable condensers he multiplied its alternations until they reached 1,000,000 or 1,500,000 per second.

Then at once an entire set of new phenomena appeared, and the experimenter entered a region of mystery and hope. One of the first things noticed was, that either because these vibrations are too rapid to excite corresponding vibrations in the nerves of the body or from some other cause, no shock is felt from the current; and that though an ordinary current at 2,000 volts will kill, yet this current at 50,000 volts cannot be felt at all.

It was also found that the vibrations keep time in some unknown way with the vibrations of solid matter. Vulcanite is one of the best insulators known, and will entirely stop any ordinary current or discharge; but the stream of sparks between two poles with this current pours through a thick sheet of vulcanite as easily or even with greater ease than through air. It does not perforate it in any way, but passes through it as light passes through glass.

All the "Crookes" phenomena of radiant matter are almost indefinitely increased; it is the blow of mitrailleuse bullets compared to the blow of an air-ball thrown against the wind. The forces can be directed for a considerable distance through space without the aid of wires. Electric lamps light easily when attached to one single wire, and require no return conductor; and, more wonderful still, if metal plates are fixed on the roof and walls of a room and connected to the terminals, the whole atmosphere of that room, whether it be ether or whether it be particles of common matter, is thrown into a state of storm and agitation which can be at once made perceptible by bringing into the space tubes or globes from which the air has been partially exhausted. Such tubes, though without any metallic connections, yet glow and throb as if powerful currents of electricity were being sent through them from an ordinary induction coil.

A Crookes radiometer placed near a metal conductor from which neither spark nor glow is perceptible, yet rotates as if it were placed near a lamp or heated body, but rotates in the wrong direction, and, last of all, a true flame burns in which nothing is consumed.

When the discharge issues from a suitable terminal it has the appearance and roaring sound of a gas flame burning under too high a pressure, and gives off a considerable heat; to use Mr. Tesla's words again: "This is not unexpected, as all the force and heat in the universe is due to the falling together of lifted weights, and the same result is produced whether these weights have been lifted apart by chemical energy, and rest in the form of oxygen and hydrogen ready to combine chemically, or in the form of mechanical energy of moving molecules directed by the electric current." On the same

table on which Mr. Tesla's experiments were shown a few days ago there swung in the year 1834 a delicately balanced galvanometer needle, under the influence of the first induction current, produced by the genius of Faraday. The force available to move it was very small, probably not greater than the forces lighting Mr. Tesla's tubes, yet that force has now developed one of the great industries of the world. It lights millions of lamps in London and elsewhere; in America it drives cars on thousands of miles of railroad, and will soon distribute the power of Niagara Falls to the inhabitants of the neighboring states. May we not hope for such development of the new discovery, and that we shall some day harness to our machinery the natural forces, which from the beginning of time have literally been slipping through our fingers.

Should the application of Mr. Tesla's results ever fulfil the bold dreams of scientific imagination, we shall see a social and political change at least as important as that caused by the railway system or the electric telegraph.

Most manual labor will become unnecessary, as unlimited power will be available at every man's hand. Engineering works can be carried out on a far greater scale than has yet been contemplated, and doubtless a corresponding era of material prosperity will set in; but whether these dreams are ever fulfilled or not, few who attended Mr. Tesla's lecture will forget the possibilities which seemed to open to their minds when they saw a living man standing in the midst of the electric storm, receiving unharmed in his hands flashes of veritable lightning, and waving above his head a tube, through which the very life-blood of creation pulsed in waves of purple fire.

GRAPHITE AS A LUBRICATOR.

A CORRESPONDENT in the *American Machinist* says: If engineers, machinists and millwrights in general and pipe-fitters in particular knew of the good qualities of graphite, I dare say there would be ten times the demand for it. Its lubricating qualities are questioned only by the impractical, and it is this quality alone that sounds its keynote, so to speak. Let me describe a few of what I consider its most important uses. As above stated, its primary object is lubrication, and it is to this fact we must credit good pipe joints and cool bearings. In making pipe cement (or as I would term it, pipe smear) it is not necessary to use the best oil or grease, as it is the graphite and not the body in which it is suspended that makes the mixture valuable and the joint perfect. I use the drippings from line shaft bearings, caught in the ordinary way, and mix it with the best Ticonderoga flake graphite so that it can be applied with an ordinary sash tool.

During the past three years I have used about fifteen or twenty pounds of dry Ticonderoga flake graphite for pipe joints, cylinder heads, piston-rod packing, etc.

Bolts, smeared with graphite mixed as above, I have unscrewed after having been in the dampest places for upward of two years, or more, proving the anti-rusting qualities of graphite. To cool hot bearings, put it on as thick as it will mix with oil.

Almost any oil or grease will answer, but don't use poor graphite.

WHERE SCIENTISTS DISAGREE.

THE well at Hull, in Sioux county, Iowa, is becoming famous. When the drillers got down some eight hundred feet they struck a rock which they at first thought to be Sioux Falls quartzite or jasper. They are after artesian water, and it is known that there is no artesian water under that kind of rock. Specimens were submitted to various scientists, some of whom claim that it is jasper and others that it is not. Prof. Colvin, geologist of the State University, says that it is not jasper. J. W. Powell, director of the United States Geological Survey, expresses the opinion that it is jasper. Prof. Floyd Davis, of Drake University, says it will take a chemical analysis to determine the dispute, and it is probable that he will be called on to make the analysis before long.

THE OLD SWIMMIN' HOLE.

'D like to see the "old flood trash,"
And "swimmin' hole" near by it;
Where us boys used to dive and splash,
And girls they wander'd nigh it.

One day we spied some up the creek,
There stonin' of the ganders,
And splashin' water with a stick,
On George and Henry Anders.

Now, George and Henry wa'n't right smart,
But they could make bark whistles,
And pull the thorny limbs apart,
And club the saucy thistles.

But nice boys George and Henry were,
And wouldn't go a-swimmin';
But me and Hill Jones didn't care
For girls—or even women.

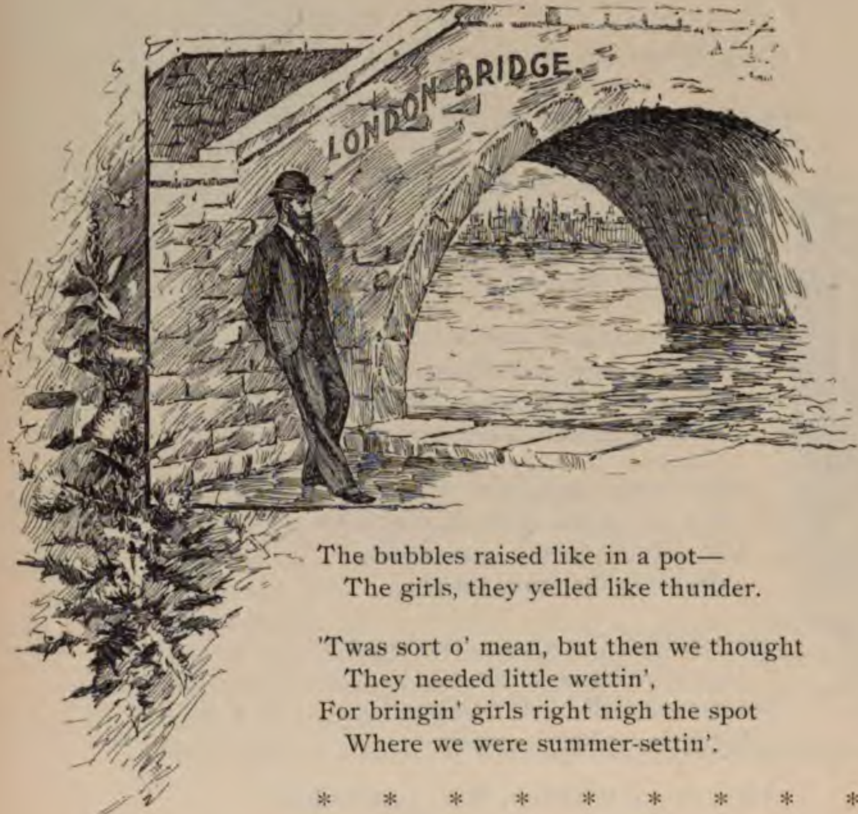
Now, George 'n Henry, Belle, Jane 'n Rose—
(I s'pose they thought it cunnin'),
Slipped 'round the "flood trash" where our clothes
Lay on a log a-sunnin'.

We seen them boys sneak down the lane—
They knowed they hadn't oughter,
And so did Belle and Rose and Jane,
Whilst we were in the water.

Then, Hill ran up one side the creek,
And I ran up the other—
The girls dodged in the cornfield quick,
And Henry hollered, "Brother!"

I caught George—Hill Henry caught,
And down they both went under—

 E—*Stone*.



The bubbles raised like in a pot—
  The girls, they yelled like thunder.

'Twas sort o' mean, but then we thought
  They needed little wettin',
For bringin' girls right nigh the spot
  Where we were summer-settin'.

* * * * * * * * *

And now, while far across the sea,
  Midst London's smoke and clatter,
With tears these scenes come back to me--
  I wonder what's the matter.

I would that I might see again
  The mullen-stalks and thistles,
That growed along the paw-paw lane
  Where Henry made his whistles.

The blooming of the peppermint---
  The catnip by the hedges—
The flying of the white-wood lint,
  Along the creek and ledges.

I want to see the apple-flowers—
  The peach-tree and the cherry;
Just after one of April's showers,
  That made them look so merry.

The nettle with its "urgers-on,"
  That stuck right through our breeches;
The touch-me-not that growed along
  The log fence and the ditches.

I want to see the pumpkin blows,
  That lovely yellow posey,
That down beneath the broad leaf grows,
  So dewy-like and cosy.

The chestnut and the locust trees,
  And blooming fields of clover
That fed the busy bumblebees,
  And scented us all over.

The "little hole" that wa'n't so deep—
  Where Hill and I caught minners,
And where in spring we washed the
    sheep,
  And preachers ducked the sinners.

But what would please me most, you
    know,
  Would be to see those lasses,
Just as I saw them years ago,
  There in the corn and grasses.

If I could only see them girls
  I'd let poor Georgie paddle;
And run right out and muss their curls—
  Ha! how they would skedaddle!

J. Murray Case.

OBSERVATIONS ON TIN-PLATE.

THE N. & G. Taylor Co., of Philadelphia, Pa., send us the following interesting description of its manufacture, and other matters relative to its production. There are two ways of making tin-plate, the pure palm oil process and the acid flux process. The pure palm oil process is slow but it is the best and the only way by which really fine and durable plates can be made. The acid flux process is quick, cheap and easy.

That we may give you a clear illustration of the latter we had better take IC 14x20 cheap roofing tin, which is composed of 105 pounds of sheet iron or sheet steel, an article of American manufacture which no one will deny who has any knowledge of the output of our rolling mills. Now what is done with this to make the finished plate? The sheets are pickled and washed, a very simple and cheap process already done in hundreds of plants working in this country in the making of galvanized iron, etc. They are then taken to a patent machine, worked by two boys. This machine contains about 500 pounds of metal, the proportion say about one pound of tin and nine pounds of lead. At the present value of metals this mixture is worth less than six cents per pound.

These two boys can tin the sheets at the rate of thirteen per minute. You therefore see they can finish a box in about nine minutes and the amount of coating put on is one and one-half pounds. To arrive at the value of a box of such tin complete you take nine cents as the value of the metal; the boys' wages for nine minutes and add the value of the sheet iron or steel and the cost of cleaning it, the total being the net cost. This is the entire situation.

A country that can produce almost everything, from a pin to a locomotive, should surely be able to take the output of its rolling mills and simply coat it with pure tin or a mixture of tin and lead. To those who take the position against the industry on account of the question of block tin we would say that the British or Welsh manufactures do not get their tin at home. There is no tin in Wales and what little is mined in England is not of a quality suitable for making tin-plate. All tin used in making tin-plate comes from the East Indies, and London is the principal market. If we, as manufacturers here in Philadelphia, were compelled to go to the same market as the English or Welsh manufacturers we would not pay any more for our tin landed here in Philadelphia than the manufacturers in England or Wales, who pay more than thirteen cents per 100 pounds freight from London; the ocean rate of freight from London to Philadelphia being only thirteen cents per 100 pounds and the only difference in cost between the tin-plate made in Great Britain and America is the simple item of labor.

THE POWER OF WATER.

THERE are very many, generally unknown, peculiarities about water as a power-producing agency, even to a great many mechanics that are quite efficient in practical hydraulic engineering. The spouting velocity of water is controlled by the same law as falling bodies. As an instance the spouting velocity of water under a 16-foot head is the same as that of a body falling 16-foot, that is, the velocity of the falling body at the end of the 16-foot fall is the same as the initial velocity of the spouting water from under a 16-foot head, both being 32.4 feet per second.

The velocity from under a 64-foot head is 64.8 feet. It strikes the careless thinker as being quite strange that water should have a spouting velocity of 32.4 feet from under a 16-foot head, and why 64.8 feet from under a 64-foot head,and each are apt to jump at the conclusion that as the head increases in height it loses relatively in power. That, however, is very far from being true. A 20 inch water wheel will yield eight times as much power under a 64-foot head as it would under a 16-foot head, but would, of course, use twice as much water. The power developed being always directly as the quantity of water used and the height of the head.

The square root of the multiple of increased height is the multiple of the increased spouting velocity. Thus, as we have seen, the head has been increased from 16 to 64 feet or four times, while the spouting velocity was increased two times only, two being the square root of four.

The spouting velocities of streams of water issuing from under various heads is as the square roots of the heads; or, in other and plainer terms, velocities increase in exactly the same ratio that the square roots of the heads increase; and a convenient way to ascertain the spouting velocity of any given head is to take the square root of it and multiply it by the constant factor 8.1. As an example we will take a head of 16 feet the square root of which is four, which multiplied by 8.1 equals 32.4 feet the velocity of a 16-foot head. Again we have a head of 64 feet the square root of which is 8, which multiplied by the constant 8.1 equals 64.8 feet per second, the spouting velocity of a 64-foot head.

Now, if we take a 4-foot head as a basis and call its useful effect one, we are able to construct a simple formula for ascertaining the relative useful effect of any other head. First obtain the spouting velocity of the head as above explained, and divide it by 16.2 which is the spouting velocity of a 4-foot head; then divide the height of the head in feet by four and multiply the two together and the product will be the efficiency as compared with a 4-foot head. As an example take a 16-foot head the spouting

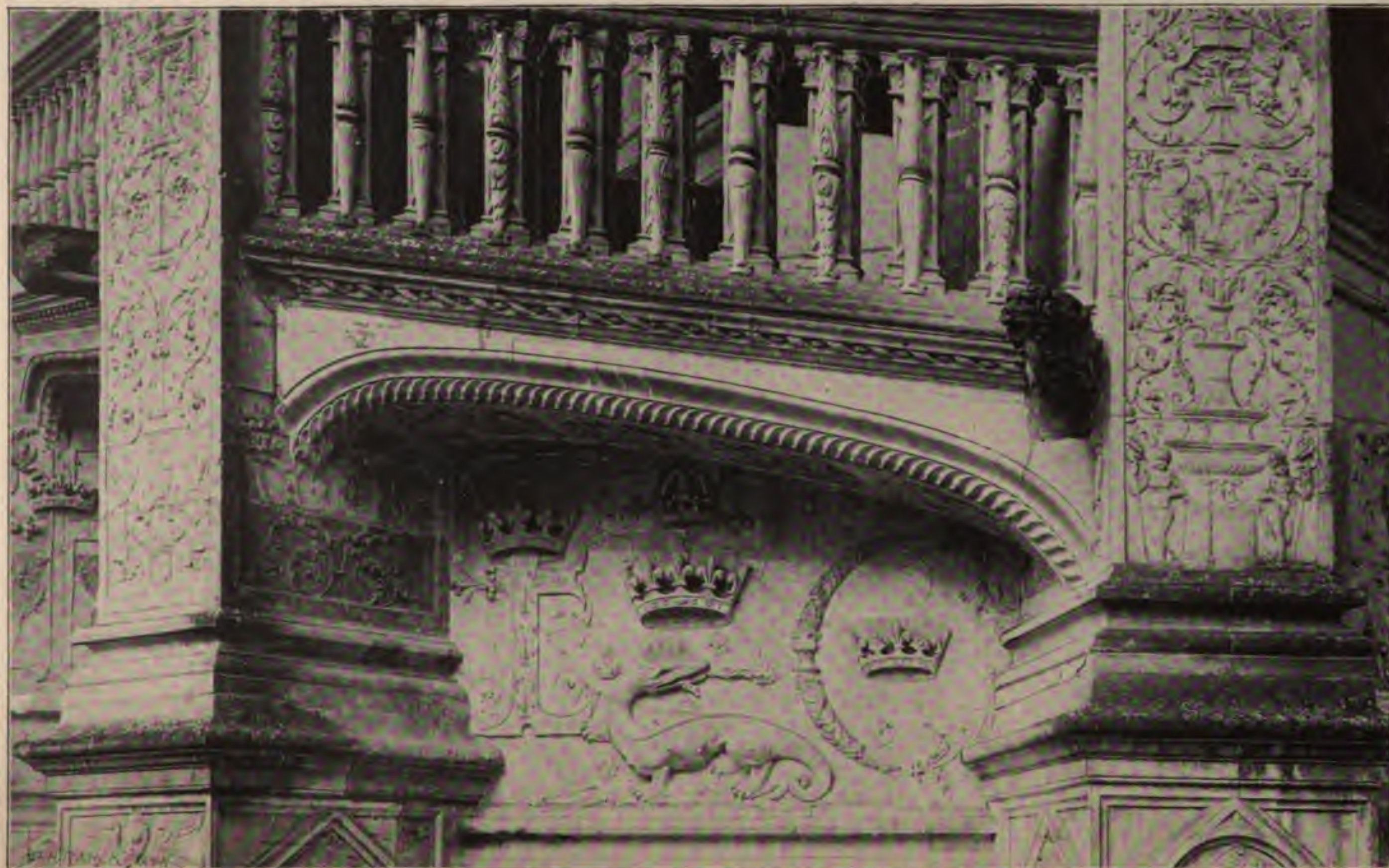
velocity of which is 32.4 feet, which divided by 16.2 equals 2; and 16 divided by 4 equals 4 which multiplied by 2 equals 8. Therefore, the efficiency of the 16-foot head is 8 as compared with one for the 4-foot head. Or again, take a 64-foot head, the spouting velocity of which is 64.8, divided by 16.2 equals 4, and 4 divided into 64 equals 16 which multiplied by 4 equals 64 the efficiency of the 64-foot head being that many times greater than the 4-foot head. It must be understood that the vents are the same in size in their calculations. As the size of the openings are decreased or increased, the effectiveness is decreased or increased in proportion.

The result of these calculations are only relative to get at actual results. In any case we must know the actual quantity of water that can be used.

ACTION AND REACTION.

REACTION is sometimes mistaken for direct action and especially is that true in reference to water wheels as now generally built. The reason of that being that the water as it leaves the wheel seems to move in one direction while the wheel moves in an opposite direction. That, however, is rather more apparent than real; the fact being that the wheel either travels in the same direction as the water that impels it, or, on a line at, or about, at right angles with the water which drives it, depending on the style of the wheel and the manner in which the water is delivered to it.

By action, as a general mechanical term, or to be specific, direct action, is meant moving forward in the direction of the moving force. Reaction means moving backward or in the opposite direction taken by the moving force. No better illustration of the two actions can be found than in the firing of a cannon for instance. The direct action of the explosive on the ball sends it forward with terrific force and speed; on the contrary the cannon and carriage leaps backward at the same instant. The ball is sent forward by direct action and cannon backward by reaction. This is a simple definition of the two terms and prevents confusion as to the meaning of both.



STAIRWAY IN THE CHATEAU OF BLOIS, FRANCE.

DECORATIVE STONE-CUTTING.

PERIODS of transition are always interesting. The Romanesque and Gothic architecture of the Middle Ages had their own peculiar and beautiful development. The early Romanesque of the Eleventh and Twelfth centuries contained not a few suggestions of detail which show that there was a definite connection, in small ways, between this architecture and the early Roman work. However, these suggestions were soon left out, and in the latter part of the Twelfth and during the Thirteenth centuries, all influence of the Roman architecture was obliterated. The Roman suggestions and the Roman influence showed only in details of decoration; never in constructive parts, in the plans of the buildings, or anything else than a few decorative details and general decorative forms. After this, in the Thirteenth and Fourteenth centuries, came the Gothic architecture, pure and simple; Gothic architecture in its highest state of development, without the slightest trace of the influence of the Roman architecture and with only a few suggestions of the Romanesque. In the Fifteenth century, however, there were changes, and the Sixteenth century saw the beginning of the full development of the Renaissance. Thus we have in the Eleventh and Twelfth centuries a tendency toward Roman architecture in matters of detail, and again in the Sixteenth century we have a return to Roman forms in something more than mere matters of detail. There was an alliance not only in forms but in constructive principles. Renaissance means a return or a revival; the Renaissance of the Sixteenth century was a return to revival of the old Roman architectural forms.

The photographic cut which accompanies this article is that part of the Chateau of Blois which was built under Francis I. Its beauty and peculiar qualities lead one to remember that periods of transition were always interesting. This was built in one of the most interesting periods in the history of architecture, at the time when the change was being made from the Gothic to the Renaissance. Such a period always has its own limit, its own spark of fire, its own relation to the past, together with a very clear and definite relation to that which is to come. Periods of transition are always productive. It would appear that with the changes and experience of later years a more beautiful architecture would have been developed than that of the beginning of the Renaissance. Not so, however. Added experience has given nothing more beautiful or successful than the work of this period.

The very lack of precedent and formality, the freedom and exuberance in design, made this an architecture incomparable with anything which has been developed since. The same general statement applies to the Thirteenth century architecture—the Gothic. There was then no experience in Gothic construction, yet this early Thirteenth century Gothic was better than anything which follows; more beautiful, more rational and more enduring. The later Gothic became more brilliant, more decorative, more flamboyant, but was not so rational, logical, or beautiful as in the first period of its history. Thus it would appear that nothing was gained by experience in the history of either the Gothic or the Roman architecture.

The wealth of nations, the examples before us, have not enabled us to approach the architectural beauties of the Thirteenth or the Sixteenth centuries. With all this architecture before us in reality and in photographs, and with the time to study it we are yet unable to design anything that approaches it in beauty. The Sixteenth century architecture, particularly the work of the time of Francis I, was a revival of the old Italian work. But it was seen through new eyes, handled with a new spirit, and infused with a new life. The Roman architecture before its decline became formal and stiff. The artists of the Renaissance saw this architecture and realized the essence of beauty there was in it. The training which had come through generations of Gothic architecture enabled them to take up what was stiff and formal in the old Roman architecture, and give it the fire and life and brilliancy of new thought, and the exuberance of freedom. In this stairway of the Chateau of Blois, located in the middle of France in the valley of the Loire, we have one of the flowers of the Renaissance.

It is not pleasant to think that if one had a piece of decorative work of this character to do to-day it would be well nigh impossible to secure its execution. We are without the artists; without the ability to carry forward such an undertaking. A few years ago Mr. Richardson came back from the School of Fine Arts in Paris, bringing with him a knowledge of Romanesque architecture. He put it to use. We find in him the most successful of American architects. We have all over the country his imitators, yet none are his equal. He went to the fountain-head for his source of information. He studied the Romanesque architecture of France and Spain. His imitators have studied it from Richardson, from photographs of Romanesque architecture, or at most have made flying trips through the country in which it was developed. We do not give it the serious thought or years of study which enabled Richardson to use it so successfully. We hear that the Romanesque architecture in America is on the decline, and that the Renaissance is the coming architecture of America. We have this statement justified in the successful work of McKim, Mead and White of New York, and in the general preference shown for Renaissance architecture in

the Exposition buildings in Chicago. We now have imitators of McKim, Mead and White and other successful architects, who undertake to design in what they call the Renaissance. They do this without knowing this architecture. The result is that we have, spotted all over the country, indifferent, common architecture, sailing under the name of the Renaissance. A few architects understand and handle it well; the masses are mere bunglers and imitators without education or knowledge to justify them in the use of any style. Their work is sure to be bad under any circumstances or conditions.

As said before, if one designed a building wherein the decorative work was as profuse as in the Chateau of Blois, he would be unable to have it executed because there is no one who is able to carry out such an undertaking. In many sections of this country, in many of the larger cities, serious-minded architects do not undertake to have decorative work of an elaborate character executed. It is really not worth while to undertake it. Carvers and decorators who can do this work are not at hand, and rather than undertake anything spirited, with the knowledge that it will fail, they take up the conventionalized decorative forms where there is a reasonable probability of fair success in execution.

It is very difficult to secure originality in decorative design; it is practically impossible to secure the execution of anything of high character. It is even difficult to secure the execution of forms and designs which are well known. It is well to know why this is true. Why is it that in a city like Indianapolis, for instance, a city of one hundred and twenty-five thousand, it is well nigh impossible to secure the execution in stone of good decorative work? Is it because the effort has not been made? Not so. We are finishing a library building—an ambitious structure designed in the style of the Renaissance. The general execution is good; the decorative work is a failure. The effort was made. Realizing the difficulties to secure good workmen, and to insure success, those interested sent to Cincinnati for the best artists they could find. The matter of cost was not seriously considered, the first and prime object being to get good work. But the carving is atrocious; the surfaces might better have been left blank. There are hundreds of other structures in the country in the same lamentable condition. People are ambitious of high results, they are willing to pay for them, but the artists are not at hand.

Here lies the difficulty. Those engaged in this kind of work do not realize that it requires an artist in the same sense that it requires an artist to paint a picture or carve a statue. This kind of decorative work is as much sculptural work as though the human figure were the subject of execution. One may study drawing and sculptural work in our country in so far as it relates to the human figure, but our schools of decorative sculpture

are not worthy of the name. Hence our decorative sculpture is not as a rule good. It is not artistic, because we have not the artists. We cannot have artists until we have schools or other means of instruction in decorative work. It takes the same class of ability the same character of instruction, the same patience and enthusiasm to make a success in decorative sculpture that it does in any other branch of artistic work. We have many painters who fail not because they are without ability, but largely because they do not meet with proper appreciation; because they do not meet a popular demand. They say that the public is not educated to the high standard of artistic appreciation which makes it possible for painters and sculptors to thrive. This being true, we may ask how may the public best be educated? Certainly by artistic surroundings. If we put up a library, school building, church or other structure, public or private, why not educate the public through its excellence? Should not many young artists who paint or do sculptural work, exercise their talents in decorative sculpture? The field is broader, quite as remunerative, and affords quite as high a scope for ambitious talent. Decorative work on buildings is always wanted. The demand is greater than the supply. The artist has quite as large a field, one infinitely more remunerative and quite as artistic, and one which will reflect quite as much credit as to those engaged in the larger work. Our young men and young women who study painting and sculpture in the sense as originally understood, could get a great deal better and more profitable employment in decorative art and decorative sculpture than in the narrow field on which so many go down with blasted hopes. A good decorative sculptor is always sure of remunerative employment. People with ability as painters and sculptors in the ordinary sense are rarely sure of remunerative employment.

Our schools would be supported by the public much more willingly and with a more lavish hand if the work were given a practical direction, than now where it is less practical, where it merely leads to the painting of canvases to go into frames, or sculptural work to stand in public places. Our schools should teach young men and women to carve work which could go on our buildings, to carve in wood-working establishments and elsewhere, and add to the artistic value of the material which they touch. The public would much more readily support schools which promised such great public benefit. This work need not be confined to sculptural or decorative work as applies to buildings. It might be directed to the designing of carpets, of wall paper, calicoes, and in fact to the embellishment and decoration of anything where such work adds to its material value.

This is the practical side of matters artistic. It is the side of artistic instruction and artistic production which will touch the money making, material instinct of the American people. In it lies the development and

expansion of American art. We look to material things and material success. When we look to artistic development, we look to it through material eyes. With artistically designed furnishings, well designed dress-goods, artistically carved buildings, we will find the proper direction of the material side of artistic development. We will find here an every-day educational influence which will bring us to the realization of the esthetic value of all artistic work. If a painter cannot lead his public to appreciate his work, why should he not have tact enough to lead them naturally, through the material instincts of the American business mind, and thus touch his soul and afford an outlet for artistic work. This will come from art schools, and art schools must come through public realization of the good which they may do.

Louis H. Gibson.

ODD USE OF A NEW INVENTION.

DURING a residence of two years in a tomb at Gizeh, Wilhelm M. Flinders Petrie collected evidence showing that the tools used in working stone 4,000 years ago were made with the jeweled-cutting edges, as in the modern custom. He has stated his reasons for coming to these conclusions and proves in a very satisfactory manner that the pyramid-builders used solid and tubular drills, straight and circular saws, and many other supposed modern tools in erecting that greatest of buildings. He also shows that their lathe tools were set with jewels and that they did work with them that would puzzle the modern artisan. In one place he found where the lines of cutting on a granite core made by a tubular drill form a uniform depth throughout, showing that the cutting point was not worn as the work advanced. The regular taper of the core would also go to prove that the drill was set with jewels on the inside and on the outside alike, thereby facilitating its removal. In some specimens of granite he found that the drill had sunk one-tenth of an inch at each revolution, the pressure necessary to accomplish this having been at least two tons. The capacity of the tools and the skill of the workmen are illustrated by the clean cut they made through soft and hard materials alike, there being no difference in the width of the groove when it passes through soft sandstone and granite hard as iron. Nothing is known concerning the material of which their tools were made, nor how the jewels were set. The diamond was very scarce at the time, therefore the only logical conclusion is that they used corundum.

NOTES ON QUARRYING.

ROCK BLASTING BY ELECTRICITY.

FIGURE 1 illustrates the interior construction of the first successful magneto-electric blasting machine the invention of Mr. H. Julius Smith, and is sometimes known as the "Plunge" or "Rack" battery. It is constructed on the principle of a regular dynamo in that it is a magnet of the horseshoe character, of iron, wound about with coils of insulated copper wire. Between the poles of the magnet there is fitted to revolve an armature of cylindrical construction, carrying in its body other insulated copper wire coiled longitudinally as to the cylinder. The rapid revolution of the armature by suitable means generates and sustains in the machine an accumulative current of electricity of great power, which at the moment of its maximum intensity is switched off to the outside circuit in which are the fuses, and in the interior of each fuse the ignition is accomplished instantly.

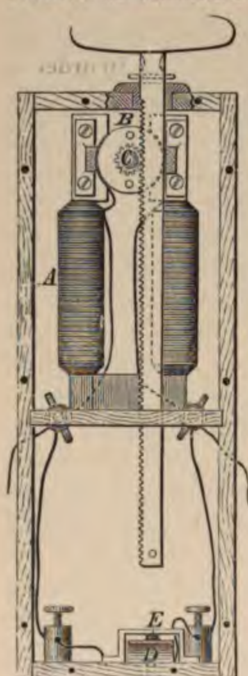


FIG. 1.

A is the principal magnet. B, the armature revolving between the poles of the principal magnet. C, the loose pinion, its teeth engaging with the rack bar, and by a clutch also engaging with the spindle of the armature on the downward stroke (only) of the rack bar. D, the spring, which, when struck by the foot of the descending rack bar, breaks the contact between two small platinum bearings, and this causes the whole current of electricity to pass through the outside circuit—the leading wire and fuses. E, the two platinum bearings, one on the upper face of the spring, the other in the machines, as at present constructed, being a screw with a platinum point, passing through the yoke above the spring. The points at which, after long use, failure is most likely to occur, and repairs may be needed are as follow: The small pinion C, by violent usage may break. A new one can be fitted with little trouble. The platinum bearings at E may be fouled by dust or other foreign substance; it is necessary that these should

be bright and clean. Opening the case at the back, examination and cleaning if, necessary, can be easily accomplished. The "commutator" is a thin ring of copper like a section of a tube (or would be so were it not divided by a saw cut on each side into two equal parts) fastened upon a hard rubber hub. The "commutator" has pressing upon it (on the outer surface of the ring) two copper springs. These should press firmly upon it, and its surface should be bright and clean. In the course of time, particularly if the machine should have been used, this surface may become tarnished, then it will be necessary to make it bright. Rubbing with dry emery paper will serve this purpose, afterward the surface should be slightly oiled. Also, small particles of the copper, the result of the wear of the ring or the springs, may fall into the crevices between the two parts of the ring. If these crevices become filled with dust or copper, the result will be to weaken the effectiveness of the machine, as it is necessary that the two parts of the ring should be insulated. In order to cleanse this ring or commutator the rack must be taken out of the case, which can be done by removing the small screw near the lower end, then the interior working parts of the machine, with the shelf on which they rest, can be moved partly out of the case—far enough for the purpose. The parts being within reach, remove the springs which press upon the commutator and the yoke which holds in place the spindle upon which the comntator ruus, and the latter can then readily be cleaned and replaced. This machine should never be exposed to excessive or long continued heat; should not stand for over an hour at one time in the hot sun, or where the thermometer may show, say ninety degrees of heat. That heat which will melt sealing wax might be destructive to the machine.

FIG. 2—*Firing blast with the Crescent Battery.*

Two sizes of the "Plunge" battery are made, known as the "No. 3" and "No 4." The capacity of the "No. 3" is about 12 holes, and of the "No. 4" about 25 holes, but many persons claim that they can fire a greater number of holes with the smaller, "No. 3," battery than with the "No. 4." With a "No. 3" machine in good condition one is more likely to fire a larger number of holes than with the "No. 4" because of the resistance which the

latter offers in pushing down the handle and the difficulty in getting up speed enough in the armature to discharge a strong current. It is obvious that to get the best work out of the "Plunge" machine the handle must press down in a perfectly straight line without bearing either way and the greatest speed must be acquired at the end of the stroke. It is a difficult matter for anyone, no matter how experienced he may be in the use of these batteries, to discharge exactly the same quantity of current at each operation. To get the best result out of the battery one should take hold of the handle with the right hand and lift it to its full length, then press it down, at first with moderate speed, but finishing the stroke with all possible force bringing the rack to the bottom of the box with a solid thud. Some persons in using this machine give the rack a churning motion before pushing it all the way down. This is no advantage whatever; on the contrary, it is likely to injure the machine, as by several strokes in quick succession enough heat may be generated to destroy certain parts of the machine. The current is no stronger because there is no such thing as storing the electricity, the chief point being to get high speed at the end of the stroke.

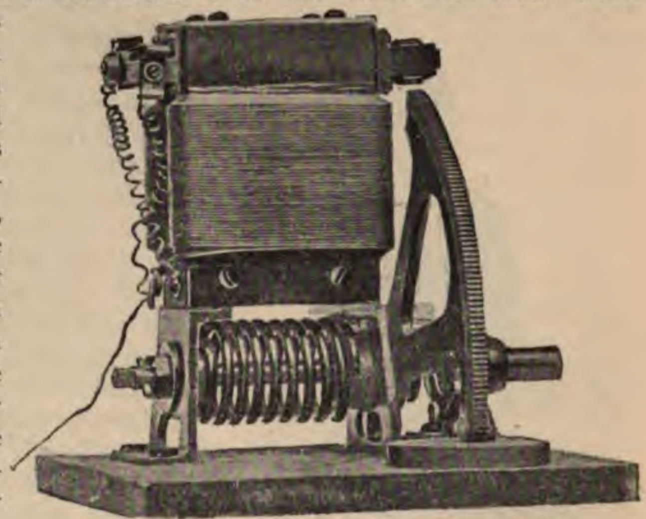


FIG. 3.—*Showing Interior Construction of Crescent Battery.*

Another form of battery used in America is similar to the "Plunge," but is fired by pulling a rod or tape instead of pushing a rack. This is known as the "Pull-up" machine. Its general construction is similar to the plunge, the chief difference, besides that already referred to, being in the method by which the circuit is changed. Instead of striking a key at the end of the stroke the current is thrown from the short circuit of the machine into the long circuit containing the exploders by simply breaking the short circuit.

Fig. 2 illustrates a new form of battery known as the "Crescent." Its interior construction is shown in Fig. 3. The "Crescent" battery is distinctly different from all others in the method by which the current is discharged. In principle it is identical with the "Plunge" or the "Pull-up" so far as it consists of a magnet with an armature at the poles. In the "Crescent" this

armature is revolved by a rack which is a segment of a circle. The power which generates the current in the "Crescent" is a strong steel spring. The operator simply presses this spring to a point from which it is automatically released. The current is thrown into the line at the end of the stroke by breaking the circuit, the rack and the pinion on the armature shaft forming a short circuit. This circuit is broken by the fact that the pinion and quadrant are separated within a short distance of the end of the stroke and the current which has been produced, and which will in all cases take the shortest circuit, is now forced to take a path through the leading wires and exploders.

Wm. L. Saunders.

ARCHITECTURE AND THE ALLIED ARTS.

IN treating the subject of architecture and the allied arts it becomes apparent that two forms, painting and sculpture, have received the most attention from the artists of all time. Other forms of art, as metal work, enamel, mosiac, painted glass and similar minor forms were developed chiefly in some one style, and even though they were employed in many others, they sank into subordinate positions. Painting and sculpture, however, are present in nearly every form of architecture, and generally in a well-developed state.

It should be noted that as mankind advanced they made use of a great variety of arts, so that in the Gothic, the latest of all the original forms, nearly every phase that had been employed in previous styles here finds a definite and characteristic use. The manner of using different arts varies with the progress of taste. There is a gradual evolution of sculpture from the low reliefs of the Egyptians to the full round of the Greek, Roman and Gothic. Painting is chiefly employed to depict scenes, even in such widely separated styles as the Egyptian and gothic. It is, however, often used to color ornament and in the representation of ornamental designs. The Greeks, for example, made large use of painted ornament, which in other styles, the Corinthian, for example, is displaced by sculpture. Metal, while used in a splendidly barbaric manner by the Assyrians, becomes a most useful and well subordinated ally in other styles.

In making use of the allied arts as adjuncts to architecture no especial significance seems to have been attached to subject matter. The Egyptians covered the walls of their palaces and temples indifferently with scenes from sacred and royal life, and much the same may be said of their tombs, though here incidents from the book of the dead, and many episodes from the daily life of the people are to be found. The methods employed in the decoration are the same, whatever the subject, and the appearance of a wall decorated with sacred scenes and one covered with events in the history of a great Pharaoh exhibit no difference to the casual eye. It is the same with the Greeks, and while the gods in the pediments of the temples had a higher relief, or rather were full statues in the round, while the figures in the frieze, being chiefly of human beings, had a low relief, the difference is one of position and has no connection with the subject matter. It is the same in the Gothic, and though in the churches statues of saints and divine person-

ages are the rule, viewed from an architectural standpoint they are simply statues. Their real meaning has no special significance. The works of Raphael or of Michael Angelo are so much fresco and exercise the same function of wall coverings whether they relate to sacred or profane history. There is, at various times, a greater development of one form of representation than another, but as statues, paintings or enamel they are the same, so far as occupying certain positions in the building is concerned, and so far as they are decorative adjuncts.

One or two minor arts call for consideration. Inscriptions occupy a position of considerable importance in early forms of art. It was necessary to give an absolute name to the representation of figures or scenes in order that there be no misunderstanding as to what was represented. Accordingly these elements disappear with the progress of art. The Egyptian hieroglyphics form a very considerable part of their sculptures, and while they may never have been employed as a decoration the uses that they were frequently put to made them such. The method was, therefore, dispensed with in the later work. The Greeks use brief inscriptions, generally not more than a word or two, to indicate the individual represented, a system followed by the Romans, Byzantines and early Gothic artists. In all these styles the inscription is extremely limited and is frequently omitted altogether. With the full development of paintings the usage was neglected, for then art and intelligence had advanced sufficiently to enable the work to be thoroughly understood without any disfiguring marks. The most beautiful and successful application of inscriptions to decorative purposes is furnished by the Mohammedans, who devised what might almost be termed a special style of decoration from their writing.

One special form of decoration was practiced in Italy in the period of the Renaissance which deserves mention, namely, *sgraffito*. This mode of ornamentation, which is very simple, and in the Italian climate both permanent and effective, consists in laying on a coating of black plaster, over which is spread a thin coat of white. The design is then engraved on this, coming out in black.

It will be noticed that, in tracing the influence of the allied arts upon architecture it is too extensive a theme to be opened here, but it is a highly significant fact that the highest development of ornament of any kind is to be found in conjunction with sacred edifices. The temple and the church were the structures on which the people lavished the whole of their resources, and though in time secular buildings borrowed from ecclesiastical ones, the latter remained the finest exponents of all decorative systems. Nor is this the only reason, for sacred buildings have survived in a more complete state than secular ones, not only because they were frequently built with greater care and with better materials, but because the traditions

with which they were surrounded inspired an awe which was often a means of protection from desecration.

It must not, however, be inferred that secular buildings were in any way deficient in ornament, or that the allied arts entered into less intimate realtionship with architecture in them than in those devoted to worship. On the contrary, in every style in which a system of decoration was consistently carried out, the secular buildings were not less elaborately ornamented than the ecclesiastical ones. The palaces of the monarchs were loaded with the riches of the land, as were the temples. Sometimes, in fact, they exceeded them, as in the Roman empire and the period of the Renaissance. Different causes, however, produce similar results in these two instances. In Rome religion sunk into a civil function, and was kept up more in regard to popular feelings than from any religious feeling. In the Renaissance Europe found itself abundantly provided with churches and cathedrals, and the artistic energy which had previously been spent on the church was now devoted to the palace.

The effect of this change upon ornamentation was very great; artists were no longer confined to sacred subjects nor limited by the solemnity befitting a church. Secular art developed with an astonishing rapidity, ancient forms and methods were seized upon with avidity and an entirely new system devised which had no connection with the old ecclesiastical forms. The Renaissance was, therefore, as the period of the Roman empire, a time of the decoration of the palace as distinguished from the decoration of the church. The difference between the new and the old style was one of forms rather than of methods. The walls were covered with paintings or hung with tapestry just as the church was, though now the secular forms and adaptation of ideas to secular life gave a new and distinct appearance to the ornamentation. Into the history of this evolution it is not necessary to enter, but it should not be forgotten that in all periods, and in all styles, the union of all the arts was close and intimate without regard to the uses to which the building was to be put.

The decoration of the house was more internal than external. In earlier times, even as far back as the period of Greece and Rome, the householder prided himself more upon the internal arrangements of his house than upon its external aspect. He aimed to have his art treasures where he could enjoy them in the society of his friends rather than to display them for the benefit of an unappreciative public. Gorgeous exteriors were therefore reserved for the palaces of the monarch or great nobles who wished to impress the populace with their importance and wealth. Later, in the middle ages, the unsettled state of society prevented the use of any considerable ornament on the facades of the dwelling, and in fact the houses of the great men were nothing less than fortresses that were constantly subject to attack from

enemies who had small regard for any object of beauty. When this state of affairs had improved, some attempts were made at external decoration; but progress was slow, and it was usually confined to a small part of the facade, as, for example, the doorway or entrance. Mediæval houses appealed more to the eye by their beauty of dimension and solidity of structure rather than by an elaboration of ornament. In the towns there was a greater freedom of display, for here was less danger, but it was not until well into the Renaissance that it became usual to elaborately decorate the dwellings of private citizens.—*Barr Ferree, in the Inland Architect.*

MODERN POWER PLANTS—II.

UNDOUBTEDLY the greatest change in the use of steam in the last few years has been the introduction into stationary practice of the higher pressures and compound, triple and quadruple cylindered engines, which had previously been found so advantageous in the marine service. And here it is of interest to observe that the same influences which have been instrumental in compelling new buildings and often new locations have also made necessary strenuous efforts to lower the cost of the motive power. The most powerful of these factors has been the pressure of competition and the consequent reduction of the margin of profit, so that the difference in the cost of fuel consumed between an economical plant and a wasteful one not infrequently measures the margin between success and failure. To decide what style of steam plant will, in any given case, be the most economical, requires a careful consideration of a great many particulars, among the most prominent of which may be mentioned, the nearness and consequent price of the fuel supply and the quantity and source of the water obtainable, for it is evident that if some quality of coal, for instance, is attainable of which the price is very low, as it is in many cases where the location being near extensive coal fields those kinds may be burnt which are of low market value, then it would be the height of folly to expend any large sum in procuring economical furnaces or other expensive steam-saving appliances. The same argument holds good also where the waste of the manufacture furnishes the fuel, as in sawmills and some other places of like general character, not a few of which have to maintain some outside fire to "get away" with the overabundance of their fuel supply. In somewhat the same category is to be included many of the plants located in the smaller cities in the new gas belt of the interior where the "consideration" for the location of a new factory generally includes the "site" (of greater or less size according to the prospective value of the desired industry, and the anxiety of the locality to obtain it) and an amount of free gas sufficient for its operation to its fullest capacity.

On the other hand where fuel is scarce and high-priced it is evidently the soundest economy to put in all steam appliances of the most approved kind, as where coal costs say from $5 to $8 per ton (and steam plants are operated where it costs much more) a aving of 10 per cent., or even of an apparently

serving details for some other occasion, let me say briefly that the boilers paltry 5 per cent., will make a large difference in the profits of a year's operations. A somewhat similar state of the case exists as regards engines, but the superior running qualities of the recent "automatics" seem to have given them a great start over the older fashioned "throttles" regardless of their greater economy of steam and consequently of fuel.

While the drift of practice lately has been decidedly in the direction of compounding, many two-cylinder engines, perhaps as many three-cylinder and not a few with four having been erected within past five years, it may still be held to be an open question whether these are to be the "engines of the future" or not. A great many things enter into the consideration of the arrangement most desirable for any particular place, which of course would apply to no other, so that the reasons stated must be general rather than special, but prominent among them is the greatly increased first cost. This includes the extra cost of the boilers needed, which must be strong enough to carry the higher pressures necessary for the carrying out of the idea of gain by multiple expansion as well as the greatly increased cost of the engine itself. Of course in the almost infinite number of combinations possible in carrying out the problem of getting the most useful effect out of each unit of fuel supplied to the furnace one may generally be found which will be suited to the means at hand, as the first step may be considered as being taken in adding a condenser to the single cylinder engine and thereby gaining perhaps 10 to 15 pounds of mean effective pressure, while the addition of one, two or three cylinders carries the system out to its logical conclusion. One essential to the success of any plan for condensing the steam, of course is the ability to secure water in sufficient quantity so near the level of the condenser as either to flow to it by gravity, or so as to be easily and cheaply pumped. In one place lately visited the engines, of about 500-horse power, were of the "tandem compound" type and stood within 30 feet of a river, by which the fuel was conveyed to the boiler-house door, and from which an abundant supply of condensing water was obtained with a lift of less than six feet. While such a location is in many respects an ideal one, a plant in course of erection, by a prominent Eastern manufacturing firm, in one of the smaller towns north of Chicago, while it emphasizes the fact that the "Star of Empire," in a manufacturing sense, still "Westward takes its way" is made very interesting by the fact that the enterprise is one which has grown up in the families of the present owners, or perhaps it might be said rather that they have grown up in the business, being of the third generation engaged in it. This plant is so located as to have choice of several railroads for the conveyance of freight, with a lake frontage for the heavier traffic, and as ample capital is available their decision as to what constitutes the most economical modern plant is of more than passing interest. Re-

used are of the "water-tube" type, 4,000-horse power of which are to be in the complete plant in boilers of 250-horse power each. The engines are "tandem-compounds" condensing and are rated at about 1,500 horse power each, the condensing water being furnished by two artesien wells which deliver it where wanted, the only drawback being that it is slightly warmer than is really desirable. Of course in this case where property had been bought by the acre there was not the necessity which exists in some city sites for crowding the greatest amount of power possible into the smallest space, which is the reason often assigned for the higher pressures and more complicated engines so frequently used, and yet it seems to show that the trend of mechanical thought is toward simplicity of design rather than complexity, and that the sober second thought of the power user has rather discredited the profits to be made by saving the "vigintillionth" of a pound of coal per horse power per hour by an outlay of several thousand dollars.

It seems but fair to confess, however, that the would-be economist may in the future, as in the past, let a good thing escape him. A few years ago when the possibilities of the new field of the Dakotas first attracted the attention of capitalists to the opening there for mills, one of this class emigrated thither taking with him some milling machinery, among which was an antiquated slide-valve engine. A mill of the most approved pattern was soon erected and in operation, but for some reason or other the profits did not seem to be as large as the amount of business done would reasonably warrant. A little further investigation satisfied the owner that the leak was in the engine, which was accordingly soon displaced by a Corliss of the most approved type, with the result of doing the work with one-half the fuel which, with coal at $6 per ton by the car-load, counts up pretty rapidly even in a 100-barrel mill.

F. Riddell.

A WOODEN FLY-WHEEL.

A WOODEN fly-wheel, 30 feet in diameter, has been erected at the Amoskeag Mills, in Manchester, N. H., to replace the one destroyed by the accident of October 16, last. This wheel has a wooden rim made of ash and 9 feet wide carried on two sets of cast-iron arms, 24 in all. In the test it was run up to 76 revolutions per minute. Power is taken from this wheel by means of two 51-inch belts. The old wheel was all iron, and weighed 116,000 pounds; the new wheel weighs 100,000 pounds.

G—*Stone.*

VIEW IN QUARRY OF BUENA VISTA FREESTONE COMPANY.

THE OHIO FREESTONE DISTRICT.

UNDERLYING the hills of Southern Ohio, from a point less than one hundred miles east of Cincinnati to the famous Scioto Valley, and extending inland some twenty or thirty miles, are almost inexhaustible beds of freestone, some of which have been worked for half a century and others only opened since the introduction of railroads along the Ohio, affording other transportation facilities than the river. The largest and most important of the freestone quarries is that of the Buena Vista Freestone Co., at Buena Vista, a pretty little village lying between Portsmouth and Cincinnati. This company is more often referred to as the "Caden Company" in contradistinction to the Buena Vista Excelsior Freestone Works, operated by other parties. The members of the Caden family date their connection with the freestone interests of Buena Vista, back to the '50's and have distributed the responsibilities of caring for the many details connected therewith in such a manner as to insure absolute harmony and greatest concentration of forces. They maintain a general store, over which their offices are located, own a fleet of boats for transporting stone down the river; have their own stone mill with eight gangs of saws, and control 10,000 acres of timber and stone land, the development of which affords employment to a sufficient number of persons to people the better part of the village of Buena Vista as well as the valley up which the quarries are located. As the best stone is found four miles up this valley they have constructed a tram railway which is a model of its kind, both in the manner of its construction, the system of conducting it and in the maintenance and care it receives.

Starting from the stone saw mills on the bank of the Ohio river this tramway traverses the extensive stone-yards of the prosperous concern and turns abruptly to the right until the high banks of Twin Creek are reached, which it follows for about a mile along a road bed cut in the side of the high hills, which engineering feat, as those encountered further along this unique railway, was accomplished, unaided, by one of the Cadens. The cars are drawn by mules, who find an easy grade for most of the distance, the steeper

hills having a gravity incline, one of which is illustrated at the opening of this article. Relay stations are located every half mile and so perfect is the system of conducting this road that an empty tram-car going toward the quarry is seldom delayed by a car going down. Generally speaking, an "empty" will take the switch at a relay station just in time to exchange mules with the driver of the loaded car who travels only between the two stations relieving the driver of a loaded car at one end and taking back an "empty." So thoroughly has this custom become fastened upon Mr. Mule that in event of its becoming necessary to essay another half mile of travel unrelieved by a down traveler, the proverbial stubborness of the animal asserts itself and while the lash is being applied vigorously to his back he calmly meditates on the unreasonable demands of man who formulated customs and laws only to destroy them at unreasonable times. He has no desire to explore a half mile of road unknown to him and protests against starting in a direction opposite to that he is wont to travel until the car has been repeatedly shoved against him when he starts off, showing, however, his dissatisfaction with every step he takes.

CADEN'S MILL.

These stations are substantial structures and afford ample protection to man and beast from the weather. The Cadens cut their own timber and have their own saw mill and employ carpenters capable of building any sort of a structure, including bridges, stations and dwelling houses for the workmen. The valley is dotted with these cozy habitations for laboring men and each house is numbered so that it is readily designated in any lease, rent receipt or order for repairs.

The company gets out its own ties and keeps men constantly employed in making repairs along the line, keeping in mind the old saw that "a stitch in time saves nine." A pleasant journey of half an hour brings us to the quarries at present being worked which are located on the eastern slope of a hill. Very little stripping is required until the hill has been penetrated

to a distance of eighty or one hundred feet, and as the strata of stone which has given the Buena Vista district an enviable reputation for half a century, continues uninterrupted along the side of the hill for an indefinite distance, the process of development is carried on simply and inexpensively, enabling them to place the stone on the market at a reasonable figure, and allow a fair margin of profit. In fact they possess facilities for quarrying, sawing and shipping unsurpassed by any other quarry in the country and to the prompt execution of orders may be attributed the popularity established by this concern.

The stone in this new opening is a darker shade than that formerly marketed by them, and is of a most beautiful color and of superior quality. It is entirely free from iron rust or any other discoloring materials, as shown by the following analytical test:

Silica	90.22	per cent
Alumina	6.25	"
Iron Oxides	2.37	"
Lime	.87	"
Magnesia	0.26	"
Carbonic Acid Water and Loss	0.23	"

Twenty-five blocks of 30 cubic feet each are quarried here in a day and conveyed down the valley to the mill, where they are sawed, placed on the company's boats and conveyed to Cincinnati, the distributing point, where the company's other offices are located and where local and foreign orders receive attention.

In the next valley west are the quarries of the Buena Vista Excelsior Freestone Works, of which John Miller & Sons are proprietors. Three quarries are at present being worked by this concern, two of them being located on a railroad owned and operated by this firm. The third quarry is on the brow of a hill to the east and the stone taken therefrom is freighted by ox teams down the valley through which Twin Creek flows to the mill of the company adjacent to that of the Cadens.

The product of the other quarries is loaded on small flat cars and hauled by locomotive to the top of the hill overlooking Buena Vista and run down an incline to the mill. It is a steep grade from the bottom of this declivity to the yards of the Excelsior Company so that no power is required.

These quarries are exceedingly fortunate, however, in being so near such an excellent market as Cincinnati, which is also a good distributing point for outside sales. They are able to load from their yards and mills directly upon the barges and float same with simply the aid of the current to destination. The yards of both firms are roomy and well stocked with both mill blocks and dimension stone.

The Excelsior Company makes use of a steam traveler in its yard, while at

the Caden mill are steam derricks admirably constructed and excellently cared for, water-proof hoods entirely covering the engines and parts liable to rust. It is no uncommon thing to find flagging four feet wide and of almost any length in the yard of this latter company.

At a distance of less than twenty miles north of Buena Vista in almost a direct line is the town of Otway, where a most execllent quality of freestone is quarried by the firm of W. R. Smith & Sons. Here also is the stone saw mill of this firm, a view of which is given herewith.

MILL OF W. R. SMITH & SONS.

This mill is kept busy night and day filling orders for the buff stone now so popular among all architects and builders. At present most of their stone is being quarried at Freestone a short distance east on the C. P. & V. R. R., but they expect to shortly build an incline to the top of the hill directly back of their works where an excellent quality of rock is found without the need of much stripping.

At Freestone the quarry of this concern is found to be quite extensive and is located up in the hills, about half a mile from the railroad. The stripping is very light at this place, as the hills are not precipitous. Hauling to the railroad is done by oxen, and the relations between Mr. Smith and the officials of the road are so pleasant that no inconvenience is met with for lack of cars or means to convey them to the mill.

Contiguous to this quarry are those of Mr. Cole, the ledges of which approximate four or five feet in thickness. Further west, on the same line of road between Freestone and Otway, is Henley. Back among the hills is found the "Henley Blue," which combined with the "Otway Buff" arouses the admiration of architects and builders alike. The quality of these stones is about the same, and the texture is very even in both of them, and owing to the indefatigable efforts of W. R. Smith, Jr., and his energetic representative, Mr. C. E. Holley, of Cincinnati, their combination is finding its way into eastern cities, where it is deservedly popular.

The water-works at Eden Park, Cincinnati, contain specimens of Otway buff as do also the handsome residences of Mr. Kramer and General Goshorn, a photogravure of whose place is shown in the July issue of the *Inland Architect*.

The new bridge across the Ohio at Cincinnati drew extensively on Mr. Smith's quarries, as did also the new viaduct. The architects of eastern cities are specifying "Otway Buff" and "Henley Blue" extensively, and not a little of the buff finds its way south and west.

QUARRY OF W. R. SMITH & SONS.

Less than twenty-five miles east of Otway is Portsmouth, which has just outside its borders some very pretty bluestone in ledges of varying thickness. The greatest quantity of this stone is found along a creek two miles west of the Scioto river, called Carey's Run. Here are quarries belonging to Reitz & Co., Bode & Son and Wishon. Reitz & Co., have quarries east of the creek and highway as well as elsewhere, and have but little stripping to do, with good depth of rock. This firm has a very extensive mill in the city of Portsmouth, which we hope shortly to illustrate together with views of their yard, which is now being fitted with derricks and every convenience for handling the extensive business they carry on, not only in Portsmouth stone alone, but in that from other quarries.

In the northeastern part of the city are found the works of Bode & Son, which are kept running constantly on stone from their own quarries and others—considerable brown stone being cut by them.

Thirty miles north of Portsmouth on the Scioto Valley division of the Norfolk & Virginia R. R. is Waverly, where blue, buff and brown sand and freestone are quarried by the Waverly Stone Company—a company recently organized, and which is doing much to redeem the reputation of the excellent building stone found at this place, but which has been brought into disrepute by reason of the machinations of an unprincipled

and untrustworthy employe of the former owners. The combination of their buff and blue stone produces a pleasing effect, and a proper name for their brown stone would be "old gold." The color and texture of this stone is uniform throughout, as it is also in their buff and blue, and with increased facilities for sawing these various stones, and with energetic work on the part of its efficient officers, there is no reason to expect anything but a successful career for the new company.

Good stone is the prime factor in the success of quarry-owners, and those of the freestone district certainly have quality as well as quantity. It is claimed for freestone coming from this district that it is the most durable stone that can be put into a structure. It is entirely proof against frost, and is claimed to be nearer fireproof than any other stone known. While it is easily worked it is compact and sufficiently hard to resist any ordinary usage. It hardens with age and does not corrode, and altogether combines a great number of superior qualities for building and other purposes.

SYLVESTER MARSHALL.

THE subject of the frontispiece, Sylvester Marshall, at present well known as the President of the National Association of Quarry Owners of the United States, was born in Crawford County, Pa., about forty years ago. He was the fifth son of Paden and Margaret Marshall, and his great-grand-parents were natives of the Keystone State, leaving him, beyond a doubt, an American in all that the name implies. His family perforce, is one of the oldest in Western Pennsylvania.

His childhood was spent on a farm, but at the age of sixteen, being ambitious for something beyond its environment, he sought for an education that would fit him for broader pursuits. Acting on the determination, he was soon enrolled among the students of Jamestown Seminary, and before he was seventeen, began teaching school in the winter seasons—attending the spring and fall terms at the Seminary. The years 1874-75 found him teaching the higher mathematics and Latin in the same Seminary, a fact that bespeaks for him great application in his studies previously. In 1876, at the earnest solicitation of friends, but contrary to his own inclination, he began the study of law with his brother, the late Jas. O. Marshall, then of Pittsburgh, Pa. A few months reading convinced him that the bar would not prove congenial, and he bade final adieu to Coke and Blackstone, and an embryonic jurist thus deliberately eschewed all possibility for sitting him self on the Supreme Bench or in the White House. However, he has not had a single regret for his action from that day to this.

The years of 1879-80 found him engaged in the oil business, but the times being rendered unpropitious owning to the fact that the president of the Standard Oil Company wishing to endow an university, and needing funds, resorted to the expedient of levying on the fortunes of the lesser lights engaged in the oil trade, so that our hero, being in the dread embrace of the "octopus," was thankful to get out with a whole skin, and concluded to seek fortunes in seas then unfrequented by that kind of fish. So he left the oil country in 1881, and went to Chicago. At this time his health was poor, and he sought for a business that would keep him out doors, and in exercise, and this it was that led him into the stone business, with which, however, he did not become actively engaged until 1887, although he had sold stone on commission, as a side issue, for two or three years previously. He was one of the company that opened up the Arcadian Brownstone Quarries, near Superior, Wisconsin. Two years later he opened up the

Vernon Brownstone Quarries near Glenrock, Wyoming, and he has three quarries in operation on this property at the present time.

Believing that a man engaged in a given business should thoroughly understand all its details, shortly after engaging in the stone business, he began to make it a study, both from a practical and scientific standpoint, and since has visited almost every stone region in the United States east of the Rocky mountains, gathering information that has been of great value in conducting his business, and has led him to become recognized as an authority on all matters pertaining to stone throughout the country. The country is entering on an era calling for a better class of building materials than have been used in the past. More discrimination is being used in the selection of materials. Cheapness is not the factor it once was. The experiences of yesterday have made men wise to-day. A ledge of silica, with just sufficient cement to hold it together, is not going to make a quarry in the future. This kind of stone has been tried and found wanting, although too much of it is used to-day through its being cheap and easy to work, and all these factors have become an open book to him; that explains his success in his chosen field.

He is now making a strenuous effort to interest the quarrymen of the United States in making an educational exhibit at the World's Fair, and has made application for a sufficient amount of space to enable them to make such an exhibit. One of the ideas is to employ an experienced chartographer who will prepare maps, showing the various locations in the United States producing sandstones, lime-stones, granites, marbles and slates, used for building and ornamental purposes; also charts showing the relative production of stone by decades from said localities, from 1850 to 1890. In this exhibit it is expected to show samples of stone from every quarry in the country, together with the physical and analytical tests, and all other information obtainable bearing on the question.

He is President of the National Association of Quarry Owners; First Vice-President of the Missouri Valley Cut-Stone Contractors' and Quarrymen's Association, and General Manager, and also a member of the Board of Directors of the Vernon Brownstone Company.

NEW ENGLAND'S FUTURE.

MUCH has been written and much more will be written about New England's future. The subject is limitless and there are many phases under which it must be discussed. All, or nearly all, of those who thus far have interested themselves in the study of the problems which now confront the inhabitants of New England have overlooked many important features having great influence in determining what the future will be. Some students have touched upon one thing and some upon another; but in the opinion of the writer of this article no one has gone down and discussed the underlying matters which will make the future of New England as bright commercially as the past has been intellectually and morally.

It is useless to sit still and decry a condition of things which has resulted in a depopulation of this corner of the national domain. It has been depopulated of its ablest and noblest sons and daughters, but as the older Englishman was proud of the greater Britain, so ought we to be proud of the larger New England which has conquered a domain beside which the Roman empire sinks into insignificance, and which in most respects has never known a rival. What but the stern and rigid morality of the New England Puritan has laid the foundations of states which are empires in themselves on the basis of justice and equal rights? What but the indomitable courage of the New England born and bred man and woman, inured to the frigid winters of this latitude, would have been adequate to subdue and restore to civilization and found the grandest nation on the face of the earth inside a century? Attempts at settlement failed until that little band came to the inhospitable shores of Plymouth and there on that rocky, frozen coast founded the first free government known in the annals of human history. For all this and more our country is indebted to the New England of the past for its inspiration and the direction of the vast forces into proper channels.

Every lover, every native, every friend of New England ought to be proud of that; look back upon it as the accomplishment of the divine predestination divinely directed and humanely completed. The past of New England is secure. One hardly needs to refer to it. But the drain which has been a natural sequence of immigration has left problems which are nearly as difficult of solution as the questions which confronted the founders of these

colonies at the outset of the conquering of the wild regions in which they made their homes. We need not go back and live those times over again. We have sufficient to do to keep the forces which are acting in the present in line and not let adverse influences overcome the high aims which have been inculcated by precept and example during the past centuries of conflict with nature and other influences which have combined to compel men to cease the erection of the civilization which has been a result of their wisdom and cause a degradation of the moral and spiritual prowess of the fathers.

New England has been productive of men, great men, and pure women whose lives have purified the regions where their lots in life have been cast. Nor is she done with the production of such men and women to this day. They arise where we least expect them, and go forth to lead in the work of the world. But with that part of the question we will not deal farther. The purpose of this article was more particularly to speak of the commercial interests of New England, those interests which have suffered more severely, even, than any other by the removal of the younger men and the opening up of greater agricultural centers in distant portions of the country. Cotton manufacturing used to be supreme. Now it is one of the most productive industries and has a larger number of employes than any other in the six states, but manufacturers are discovering that competition compels a reduction in the cost of producing. Consequently here and there a mill is moved nearer the base of the raw material. The freight one way is saved by such a removal and the works can be largely increased and the profit made correspondingly greater with comparatively smaller outlay. The result is another drain on the smaller towns which always cluster around a manufactory of that sort as a center. Woolen manufactures have gone the same way, and now hundreds of small plants, which, in the aggregate formerly gave employment to thousands of people, and thereby supplied sustenance for further thousands, either those dependent directly upon the workmen for a living, or the farmers who produce the food with which they were supplied, are now no more, and the little villages are deserted, the manufactories unoccupied and falling to ruin. Numerous industries could be named in which the same thing would be equally true. And yet, if we look at it in the right light, what has been a loss to New England in one sense has been a gain in another. The removal of manufactories nearer the base of supplies has cheapened the product, so that what were luxuries twenty-five years ago are considered necessities to-day, and the poorest laborer could scarcely exist without them. New England has thus given of her life blood to strengthen the life of the nation and make the life of the poorer laborers better worth living. Ought we to complain of such a condition when we, too, are included in the same beneficent results? I think no candid student will say that we have any cause for complaint. But supposing manufacturing

has been taken away; suppose the shops have many of them gone, there are still great manufacturing centers left which are great hives of industry to call in consumers and are huge markets for the farmers' surplus products, and ought not to be overlooked when discussing any phase of the subject. The cotton industry is still enormous and the woolen industry still employs a vast army of working men and women. But I was speaking particularly of the smaller towns and villages which have suffered by the change in industrial conditions. Other matters have influenced the industrial problem, such as transportation facilities which have always been limited in the smaller centers and have always worked injury to such centers. But yet there are very important considerations that must be left untouched while we go to the main purpose of this article.

New England has in her hills and mountains vast wealth which her people are but just beginning to find and appreciate. Enormous quantities of all sorts of economical stone have lain buried for centuries in her hillsides and mountain slopes which now are being brought to the light of day and converted into merchantable products to go to the farthest boundaries of the earth. Quarrying as an industry is comparatively new. During the past fifteen years it has seen a greater development than for a century before, and the past five years has seen an awakening to the fact that though the smaller manufacturing towns could not compete in the production of cotton and woolen goods with those towns nearer the base of supplies, or the larger manufacturing centers which have every advantage of transportation, there are yet innumerable opportunities for the production of other things which find just as ready a sale in the open markets of the world. The quarries of New England solve the industrial problem of the future. They bring in a different class of men, but the employes of the quarries and the shops connected are as desirable as many who follow the wake of the mills. In the products of the hills and mountains lie untold wealth, and New England is only waiting the revivifying hand of capital to awake and gird up her loins and go forth to another industrial development which will be more important and lasting than was the manufacturing which has deserted her villages. In this she has the advantage of being the base of supply herself. The raw material required in the development of such a business is not dependent upon wind or weather, but is solid, immovable and no untoward circumstances can cause a short crop. Go where you will, all over the six states, and there is the same lavish burial of great financial opportunities in the bowels of earth, and they will stay there until the finger of capital shall touch them and introduce the spark of life into their now dead bodies.

Here, then, is what New England must cultivate. She must advertise her wonderful stone resources, must call the attention of capital to the illimit able opportunities for future development and prosperity, must compel by

her very importunities the stream of capital to flow in her direction and begin the development of resources which have lain so long unseen and unknown. This is the problem of to-day: To get our quarries developed that we may build up Rutland's, Barre's, Quincy's, Westerly's and other great quarrying centers about the resources which are hidden in every hill-side. The people are beginning to appreciate it and when a town's attractions are mentioned now the quarries always have a place. They should have more and they will have more when the people learn what a source of wealth they will soon become. Let the good work go on; and let the fabric of the second industrial development of New England be founded on a rock that the storms of adversity which will ever and anon beat upon it, in the course of human change and development, cause it not to fall.

Burton H. Allbee.

SOMETHING FOR AMERICANS TO THINK ABOUT.

THE Italian affair at New Orleans revealed an astonishingly weak point in the constitution of the United States, says the *National Observer*, [England] since it discovered that the Federal authorities could not interfere in the administration of justice in any individual state. All that could be done in respect of the treaty rights of foreigners was to pay an indemnity to relatives of victims, if facts seemed to warrant it. At the same time, the United States Government could not and would not let a foreign power deal with any particular state in such a difficulty as that at New Orleans. In this case Italy had little ground for complaint, because Hennessy's murderers merely got their deserts, rough-and-ready as was the justice meted out. But it might work disastrously on another occasion, and an international complication might end in a bloody war—all through a flaw in the constitution. The United States did not free England from responsibility on the ground of defective legislation in the case of the Alabama; but now that herself has had taste of a similar difficulty, at much less cost, she is about to consider a bill to empower the Federal courts to deal with offenses committed in any state against the treaty rights of foreigners. It is encouraging to other nations to learn that she recognizes any point in her constitution to be capable of improvement.

THEY were middle-aged men now; both equally prosperous and portly. Enoch Slawson had become a stone dealer in his native town, while Peter Hubble had gone to New York and developed into a substantial Wall street banker.

They had been great chums when boys; going to the same school and the same church, and rooming together and working in the same office after they grew up.

Wrestling was one of their favorite pastimes in those days. They were very equally matched, and it was only by the expenditure of a great deal of perspiration and muscle that Peter could get Enoch down and fall panting on top of him. And Enoch never seemed able to realize that Peter could "best him," if he had a fair chance. Night after night he would try conclusions with his chum, and sometimes succeed in protracting the struggle for hours, but the end was always the same.

One day last winter, Peter Hubble received a letter from a friend in Shoer's Falls which stated that Enoch Slawson had announced his intention to make a visit to New York in the spring, and added the significant comment, "he is swinging Indian clubs every evening!"

Mr. Hubble digested the contents of this letter, and divined Enoch's motive with equal quickness. *He* purchased a pair of Indian clubs and an armful of books on physical culture, and went into a severe course of training. In the early part of May, Enoch came to New York, and came directly to Mr. Hubble's house, where he was received with great cordiality. As the two friends were consuming their last cigars in the library before retiring for the night, Enoch craftily led the conversation back to their boyish amusements.

"Remember how we used to rastle in them days, Peter?" he asked.

"I remember I used to take a little gentle exercise by wiping up the floor with you, just before we turned;" replied Mr. Hubble jocularly.

"Twarn't none *too* gentle for ye, I guess;" said Enoch grimly; and yer

couldn't do that *now*, Peter, You've aged more 'n I hev. An' city life is mighty enervatin', they say."

"It hasn't enervated me any ; replied Mr. Hubble.

"I kin see it's tellin' on ye," said Enoch stubbornly ; "don't want ter try a fall, do ye ?"

Mr. Hubble silently arose and took off his coat and vest. Enoch followed his example, and the two men grappled with each other.

It was simply a repetition of the old-time contests. At the end of a half hour's furious struggle, Enoch felt Mr. Hubble's arms working their sinewy way into the familiar fatal hold, and the next minute he lay on the floor, on his back, and gazed blankly at the banker's frescoed ceiling.

Enoch rose to his feet. "My foot slipped !" he exclaimed. "But I don't see how ye done it ! Why do you know, I've been swinging Indians clubs all winter !" he continued, in sorrowful amazement.

"O, you swing Indian clubs, do you ? asked Mr. Hubble, with a chuckle as he threw open the door of the closet and displayed his gymnastic apparatus leaning up against the wall ; "Well, then, swing these."

Harry Romaine.

[Special Correspondence.]

NEW ENGLAND NEWS AND NOTES.

THE Memorial Arch at Concord, N. H., is completed as far as the mere fact of erection goes, and it was dedicated July 4, with imposing ceremonies. The arch is as yet unfinished. It calls for a bronze tablet bearing the inscription, and the one used at the time of dedication was wood painted to imitate letters cut in the stone. The rosettes and some of the other carving yet remain to be finished. All the work would have been done before the stones were put in place, but the mayor wanted to have the dedicatory exercises on his birthday and would not hear to a delay of proceedings. Consequently Concord is treated to the spectacle of an arch dedicated before it is done. The arch is built by the city of Concord to commemorate the deeds of her sons on the battle-field. It is a massive structure and contains 4,800 cubic feet of stone, weighing 396 tons exclusive of many thousands of brick used in interior construction. The extreme height is 35 feet, width 53 feet; wings 12 feet high, 14 feet long; the piers are eight feet square; the arch way is 11 feet, four inches wide between the piers and 21 feet four inches to its crown. The design is Florentine in character, and has something of what one has called the American architecture of straight lines, so much that many who have seen it are dissatisfied with it because it has not the lightness and elegance of the Greek, Roman and Gothic models which they have seen elsewhere. The design was prepared by Messrs. Peabody & Stearns of Boston and the contract for the granite was let to Messrs. Anderson & Sweanson of Concord, for $16,700. The city appropriated $20,000 for its erection. The corner-stone was laid without ceremony May 14, and the cap-stone was placed June 17. At the dedication Gen. Joseph R. Hawley of Connecticut delivered the oration and the dedicatory services of the Grand Army of the Republic were read. A large number of G. A. R. posts were present and assisted in the exercises. The parade was more than a mile long and consisted of mounted men, state militia, veterans, sons of veterans, United States sailors, national, state and city government officials. There is much feeling about the location, which is directly in front of the state house and on ground ceded by the state. Even after the corner-stone was laid a special meeting of the city government was called to see if the location could not be changed. Then the mayor persisted in dedicating it his birthday, July

4, and there is hard feeling over that, but it will all die away in time and all will be glad that the city has such a grand and imposing memorial to her soldier and sailor dead.

THE Colorado Mining and Investment Company have begun operations in the Eureka mica mine at North Groton, N. H. Mica is plentiful everywhere in New Hampshire and there ought to be a good yield of valuable mineral from this mine.

THE Jesseman Red Granite Company have bonded a quarry at Haverhill, N. H., and will start at once. The stone is said to be nearly as good as the famous red stone of North Conway and there are indications of an inexhaustible supply.

WORK on the new state library building at Concord, N. H., has almost ceased owing to the lack of Concord granite, the finishiug of which was stopped by the lockout. The contract calls for the completion in time for the roof by October 1, 1892. The work has been pushed as fast as possible with the brick, red stone and the inside iron work, but all has stopped now. Prominent lawyers say that the firm can be made to pay heavy damages by the state for non-fulfillment of contract. It is probable that the legislature will take some action on it the coming winter.

THE White Mountain Granite Company, capital $25,000, has been incorporated under the laws of New Hampshire and will open or have opened a quarry at North Conway. The stock is divided into 1,000 shares at $25 a share and the lease is for a term of years. The stock of the quarry is of excellent quality. The quarry has a face of 1200 feet and is from 20 to 60 feet high. A number of derricks can be operated at the same time. The firm proposes to furnish rough stock to such as want to buy. E. F. Hinckley, of North Conway, is treasurer and manager. The quarry is, in effect, operated by union men and those who have started in there have the support of the national organization to help them in their work.

MAYOR FAIRBANKS of Quincy, Mass., June 24 invited the Quincy Granite Manufacturers' Association and the locked-out cutters to meet him in conference. The men promptly sent the representatives, but the manufacturers refused to do so, saying that the matter was beyond them, being under the control of the New England Manufacturers' Association.

BIDS were opened June 18 for the construction of a breakwater at Frost Point, N. H. The quantity of stone is set at 24,000 tons. Thomas Liddell, $1.24 a ton; John F. Hamilton, Portland, Me., $1.49 a ton; Geo. W. Andrews, Biddeford, Me., $1.11 a ton.

OF the 450 granite workers locked out at Concord, N. H., May 14 only a

few more than 100 are now idle. They have gone to other places, or found work at something else.

W. H. PERRY of Concord, N. H., the second largest in the city, has signed the bill of prices and has his men at work. As fast as possible he will put more men at work.

THE situation in New England remains practically unchanged from what it was last month. There are 4,000 men now out in New England and there seems to be no immediate prospect of a settlement. The men are going to other parts of the country or are finding work at something else.

STONE IN EGYPT, GREECE AND ITALY.

EGYPT abounds with rocks of calcareous stone, sandstone and granite, and all these materials have been employed in the formation of the massive works which yet remain to attest the magnificence of the ancient people of that country. The walls of most of the temples were constructed of sandstone, which appears to have been chiefly obtained from the quarries stretching along the banks of the Nile, in the mountains of Silsileh; but the obelisks and statues which adorned these temples are formed of syenite or Oriental granite, drawn from the quarries in the islands of Philæ and Elephantine, and particularly from those vast excavations in the mountain terraces about Syene. The stone which has served for the pyramid of Cheops is a carbonate of lime, of a light grey color, and the same kind of stone forms the interior mass of the pyramid of Mycerinus, but the latter is covered with red granite. The monolith at Sais, was floated down the Nile on a raft, from the quarry in Elephantine. The masterpie.es of Grecian sculpture were executed in the rich white marbles of Attica and the islands of the Archipelago. The quarries of Mount Pentelicus, near Athens, supplied the materials for the Parthenon and the Temple of Theseus in that city and for the Temple of Ceres and Proserpine at Eleusis, and both in Greece and Asia Minor an abundance of stone of a greenish white was dug from the earth for the ordinary purposes of architecture. The marble of Pentelicus, which lies on the surface of the rocky mountain, was obtained by cutting the side of the hill into vertical cliffs, and about the foot of the escarpment there still remains some of the blocks of marble partly cut in forms for the shafts of columns. The quarries at Ephesus are said to have constituted an immense labyrinth, and that in the hill Epipolæ, with the stone from which the edifices of Syracuse were constructed, appears to have been of vast extent, since it was capacious enough to contain the 7,000 Greek soldiers who had been taken prisoners when the army of Nicias retreated from that city. The quarries of the Greeks and Romans were

worked by slaves, and as the labor was of a severe kind, we find frequent allusions to the practice of sending unruly slaves to work in the quarries as a punishment. We learn from Vitruvius that the buildings of ancient Italy were constructed with stones of several different kinds. This writer states that the quarries of Alba and Fidenæ (Albano and Castel Jubileo) produced a red and soft stone which soon decayed, and that the stone obtained from those of Tibur (Tivoli), Amiternum (Vitorino) and Mount Soracte was moderately hard. The Tiburtine or Travertine stone is a calcareous rock, and it appears that it was employed in constructing most of the buildings of ancient Rome. The quarries in Umbria and Picenum furnished a white stone which could be cut with a saw, and would stand well in situations where it was sheltered from the weather, but was liable to be destroyed by rain or frost. On the other hand, the red stone obtained from the quarries about the Vulsinian Lake (Bolsena) on the borders of Tarquinii, would stand both frost and fire, that would last for ages, on which account it was generally employed for sculptured works. After the destruction of Rome by fire, in the time of Nero, the houses are said to have been rebuilt of the Alban and Gabian stone, which has the property of resisting the action of that element.—*The Architect* (*London*).

THE LARGEST MASONRY DAM IN THE WORLD.

WHAT is said to be the largest masonry dam in the world is situated about sixty-five miles north of Bombay, India, to impound water in the Tansa valley for the purpose of giving Bombay a new water supply. It is a little over two miles long, 180 feet high and about 100 feet thick at its greatest depth, with a top width of 15½ feet. The bottom of the inside base is slightly battered for a short distance, the balance being perpendicular. The bottom of the outside base has a straight slope above which it is curved, with a radius of 160 feet. The waste weir is three feet below the top of the dam and about 1600 feet long. The entire foundation of this dam is solid rock throughout, and in some cases has been carried forty-five feet below the original ground level. The whole of the masonry consists of uncoursed rubble, anything approaching horizontal joints being carefully avoided. Every stone was carefully laid in mortar and driven home with a light mallet. The top course of the dam was by the use of carefully selected flat top stones brought up to a uniform level, having the appearance of rubble paving. The quantity of loose rubble stone used amounted to 14,707,000 cubic feet. The mortar used in the masonry consisted of one part of kunker lime to one and one-half of washed sand, with the exception of the lower and thickest portion of the dam in the bed of

the river, where a portion of Portland cement was added to the above. The total quantity of washed sand used in the works amounted to 3,600,309 cubic feet. The total quantity of lime used was 2,206,000 cubic feet. During the working season as many as from 700 to 900 carts were employed in the conveyance of lime, sand, etc., to the work. Regularly during the process of the work portions of the mortar were sampled, by being made into four inch cubes and after drying for forty-eight hours submerged in water. These cubes, after being thus submerged from six to eighteen months, were tested by hydraulic pressure and the general results averaged from 400 to 1000 tons per square inch before crushing. The quantity of masonry originally estimated was 10,038,591 cubic feet, and the total amount actually executed was 11,030,000 cubic feet. During the working season on an average of from 9,000 to 12,000 men were employed on the works. Before the work in connection with this scheme was started, the whole country for miles around was a dense forest and jungle almost uninhabited, and it was necessary before operations could be commenced to build a macadamized road a distance of eight miles. In order to induce native laborers to come on the works and remain there a regular village had to be laid out and built. A regular police force was established and retained at the expense of the contractors for the purpose of maintaining order, etc. Medical and sanitary arrangements for the village were carefully arranged and organized, and complete arrangements made for the proper care of the inhabitants in every way. Operations were begun in the summer of 1886, and it took five and one-half years to complete the work, which was accomplished on April 3, 1891, fifteen months before the time specified in the contract.

THE MARGHERITA BRIDGE AT ROME.

IN 1881 a law was passed by the Italian Government for enforcing the construction of at least two bridges over the Tiber, at Rome, by the city authorities. One of these, called the Garibaldi bridge, was completed in 1888, and the other called the Margherita bridge, which is the subject of this article, was opened to the public in December last. The bridge is a handsome and substantial structure.

The foundations were made with large compressed air caissons, 100 feet × 46 feet 6 inches. The depth of the foundations was intended to be 43 feet, but was afterward increased to about 52 feet, below the low-water level of the river. The foundation work has been carried out by the Société of Fives-Lille at a cost of $399,500. The superstructural work, including the

piers and arches, has been done by Messrs. Allegri, Lazzeri & Company, of Florence, in a little over two years at a cost of $232,300.

This is one of the largest bridges in Rome, and there are few that can compete with it for boldness of design, elegance of outline, and accuracy of execution. The arches of the bridge are polycentral, with five centers, their shape being approximately a half ellipse. Each arch is of 99 foot chord and about 16 feet 6 inches pitch, with a height from the foundation of 75 feet 4 inches. The tops of the piers on which the arches are based are about 17 feet 9 inches above the upper surface of the foundations and 21 feet above low-water. The roadway is about 370 feet long by 67 feet 6 inches wide at the narrowest point.

The strength of the principal materials used in this bridge is as follows: Stone of Rezzato, 1,500 kilos per square centimeter; Travertino, 900 kilos.; bricks, 180 kilos.; cement, 38 kilos. The tests were made with Michaelis' machine, and the figures given above represent an average of 950 tests made.

This bridge, along with the Garibaldi bridge, was designed by Signor Angelo Vescovali, chief engineer to the hydraulic service of the city of Rome, who has also designed two for the suburbs.

SOME LARGE GRANITE BLOCKS.

A BOSTON correspondent, writing in reference to the large block of Bedford oolitic stone mentioned as being shipped by the Bedford-Quarries Company, to an Eastern firm, a half-tone illustration of which appears on the opposite page, volunteers the following valuable information: "That was a good joke on the Indianapolis *Journal* you published in May STONE. Doubtless some of your readers may take the statement, that a block of stone 12'8"x6'3"x6'3" weighing 100,000 pounds, is the largest block of stone ever quarried in the United States, as a fact. I inclose a list of five stones in the Scott Monument, at Washington, which average over 64 tons each, one weighing as you see 150 tons rough, and 119½ tons finished. This lot of blocks was quarried in the Bay View quarries, of the Cape Ann Granite Company, in 1873, and is a fair sample of the work that has been done in the East. We can furnish particulars concerning other large blocks quarried in New England which will cast that 100,000 pound block into the shade:"

DIMENSIONS AND WEIGHT OF THE SEVERAL STONES AS TAKEN FROM QUARRIES.

	Contents.	*Cubic feet.*	*Weight, tons.*
Platform	28'2"x18'5"x3'2⅜"	$1,658\frac{11}{12}$	$150\frac{1621}{2000}$
Sub base	21'6"x11'x4'10"	$1,143\frac{1}{12}$	104
Base	18'x7'9"x3'10"	$534\frac{9}{12}$	48½
Die	16'6"x6'6"x6'	528	48
Cap	18'x8'4"x3'7"	537½	49

DIMENSIONS AND WEIGHT AFTER DRESSING.

	Contents.	*Cubic feet.*	*Weight, tons.*
Platform	26'8⅞"x17'4½"x2'10"	$1,315\frac{7}{12}$	$119\frac{1187}{2000}$
Sub base	20'2⅞"x10'6¼"x4'4½"	$921\frac{8}{12}$	84
Base	17'⅞"x7'4¼"x3'5"	451	41
Die	15'1⅞"5'5¼"x5'1½"	$417\frac{10}{12}$	38
Cap	17'2⅞"7'9¼"x3'1¾"	415	37¾

MAGICAL STONES.

STONES endowed with magic powers have held an important place in the world's belief from the days of the oracular stone in the breastplate of the ancient Jewish high priest down to the Lee penny and the murrain stone of modern times, says the Philadelphia *Telegraph*. The Cherokee medicine men maké use of several stone talismans commonly crystals found among their native mountains. One is a translucent purple stone about an inch long, with a sharp point. With this the conjurer claimed to be able to find lost or stolen articles, or to tell the whereabouts of game in the mountains.

To test the matter, a coin was thrown into the grass at random while he

was not looking, and he was told the money was his if he could find it. Procuring a string about a yard long he tied one end around the middle of the stone. Then holding the stone suspended so as to swing freely, he set it whirling in a circle with a stroke of his finger, at the same time reciting in an undertone some secret formula. The stone revolved rapidly, then more and more slowly, and stopped with the point toward the north. He walked a few feet further in that direction gave the stone another whirl, and again repeated the formula, explaining that it had to be done seven times, and that on the seventh trial the stone would point to the exact spot where the money was lying.

Having gone through the whole performance, he finally halted at the wrong place. After hunting in the grass for some time he was obliged to give it up. He declared that his failure was due to the fact that the stone was not fastened as it should have been. The other Indians said that the stone was all right but that the man was a liar, which was perfectly true, and that, although a pretty good doctor, he knew nothing of magic. They asserted that in the hands of certain conjurers whom they named, the charm never failed.

To obtain a knowledge of future events, they use another talisman. They put it into a bowl of water, where, according to their testimony, it moves about on the surface, following the direction of a knife in the hand of the conjurer, who all the time repeats his secret formula. Whipple describes that ceremony as he witnessed it among the Western Cherokees forty years ago. The talisman was a small round piece of very dry bread.

The greatest of all Cherokee talismans is the Ulasutti (literally transparent) stone. There is no end to the stories concerning this stone, which the Indians invariably speak of in a half-frightened manner, as children speak of ghosts. They assert that it is a magic scale from the head of a great horned serpent with a body as large as a tree trunk and two blazing coils of fire for eyes, which lived ages ago and worked terrible destruction among the people until it was killed by a famous magician. In the encounter a single drop of the serpent's poisonous saliva fell upon the head of the slayer, whose hair was transformed into a mass of writhing snakes.

The Indians describe it as a triangular crystal, flat on the bottom and tapering to a point, and perfectly transparent with the exception of a single red streak running through the center from top to bottom. It is evidently a beautiful specimen of rutile quartz, so that the conjurer who can obtain one outranks all his rivals.

The stone must be fed, the Indians say, with the blood of small game every seven days, rubbed over with the blood of the animal as soon as killed. Twice a year it demands the blood of a deer or some other large animal. It is wrapped in a whole deerskin and kept in some secret cave in

the mountains. Were the tribute of blood to be withheld or neglected, the Ulasutti would issue from its hiding place at night as a great blazing ball of fire and fly through the air to satisfy its appetite by drinking the life blood of the conjurer.

The original owner was afraid of it, and he changed its hiding place frequently, so that the stone might not be able to find its way out. When he died it was buried with him, as otherwise it would issue from its cave by night, like a fiery meteor, to search for his tomb night after night for seven years. But if unable to find its owner, it would go back to sleep forever where he had placed it.

As far back as 1762 Timberlake heard of the stone, with the wonderful story of its origin. He said that it was kept hidden in some place known only to two women, who refused to betray the secret. Adair, the celebrated trader, also speaks of it a few years later. The conjurer refussed to let him see it for fear of profanation.

RUINS OF JAVANESE ARCHITECTURE.

THE architectural ruins of Java surpasses those of Central America, says a recent issue of the *Home Journal*. At Chandi-Sewa are found the remains of what was once an assemblage of 296 temples, arranged in five parallelograms, one inside of the other. In the center of all is a large temple in the shape of a cross, surrounded by 40 flights of steps, richly ornamented with sculptures and containing many apartments. Eighty miles to the eastward is the temple of Borobods, consisting of a central dome 50 feet in diameter, around which is a triple circle of 72 towers, the whole building being 620 feet square and 100 feet high. In the walls are niches containing 400 cross-legged figures larger than life. The amount of human labor and skill expended upon the pyramids of Egypt sink into insignificance when compared with that which was required to complete this sculptured temple in the interior of Java. Forty miles southwest of Samarang, on the same island, is an extensive plateau covered with the ruins of temples, to reach which four stone stairways were constructed, each containing more than a thousand steps. Traces of more than 400 temples are found there, all of them decorated with rich and delicate sculptures. In Eastern Javá the ruins of forts, palaces, baths, temples and aqueducts are to be seen everywhere.

A REVIVAL OF THE STONE AGE.

THE following interesting paper was read by J. Gash, before the California Society of Architects. It is a review of the ancient methods, and modern tendencies, that seem to be well foreshadowed by the more general use of stone in all of our cities, and even in the smaller towns. What the writer says of California quarries will apply equally to Indiana, Illinois, Colorado, the Cumberland region of the South, and to New York, the Lake Erie District, and to New England. It is, indeed, as our author puts it, a revival of the stone age:

I have taken for the subject of my paper to be read before you this evening, stone and its use in architecture, and, although heading it,"The Stone Age," I will confine myself to its use in building, avoiding viewing it from a geological point as much as possible. Man, in the primitive state, sought shelter from the inclemency of the weather in caves and holes in the ground, and sustained himself by hunting and fishing, and later on, when the human race began to increase, and civilization turned its attention to other sources for maintenance, took to herding of flocks and roamed from place to place for pasture for their flocks; with this came the building of tents. Next came the commercial period, and with it the growth of towns and cities. The tent period is remembered by the pioneers of our city. Next came buildings of wood, this material, being more easily gotten and cheaper than stone was, being used for a long time—in fact, to the present day.

That stone should be used for building no doubt arose from two causes—a desire in the human mind to perpetuate the age in which they lived, and the fear of conflagrations. The former is evidenced from the desire of the people, who lived after the flood, to build themselves a tower that might reach to heaven, preserve themselves a name, and also to save themselves from any future floods. There being no architects in those days, of course the undertaking was a failure.

The temples of religious worship seem first to have given building of stone an impetus, and to have sown the seed in the art of building, and to have laid the foundation of the science of building called architecture. The earliest records of such buildings are the pyramids of Egypt, the buildings of Greece and Rome, the building of King Solomon's temple, and later on, the cathedrals of Europe. The great pyramid of Egypt, Herodotus

tells us, was built by Cheops, king of Egypt, about 1900 years B. C. He says 100,000 men were employed twenty years in building it. The second was built by Cephrean, his brother, and the third by Mycesrinus, the son of Cheops; the height of the first pyramid is supposed to be 456 feet, and each side of the base 763 feet.

Buildings of this description are not confined to Egypt. They are found in the East Indies, Babylon and Mexico. The temple of Belus at Babylon, is of pyramid shape, and has a perimeter at base of 762 yards. The next in size to those of Egypt, now existing, are those of Mexico. About eight leagues northeast from the City of Mexico, a great pyramid is found. It has a base of 1,440 feet, and the area of the base is, therefore, upward of 47½ acres of land. A colossal stone statue, covered with gold, stood on its summit, but the soldiers of Cortez carried off the gold, and the statue was broken.

The East Indian, Babylonian and Mexican pyramids were built for religious purposes partly, and partly for burial places, but there is no trace of evidence to show that the Egyptian pyramids were built for any purpose but preserving the dead and perpetuating the names of those who built them.

Of the temples of Greece may be mentioned the Parthenon, in Athens, measuring 100 by 228 feet, and Jupiter Olympus, 95 by 230 feet, being built about 435 B. C.; and of Rome, the Pantheon, the main element of which was a cylindrical structure surmounted by a dome, measuring 139 feet in diameter; the temple of Ephesus, 220 by 425 feet, and later on the Church of St. Peter's in Rome, measuring 966 by 226 feet; St. Paul's, of London, 180 by 500, and La Madeline, in Paris, 138 by 328 feet. The thirteenth fourteenth and fifteenth centuries cover a great era in the erection of stone buildings, and the rise and growth of Gothic architecture, also of modern Freemasonry.

In our own time, we may be said to be drifting steadily into a revival of the "stone age," as may be seen in the city of San Francisco. It is not yet fifty years since granite was shipped from China to this city for building purposes, yet here were the Penrin and Rockport quarries lying in death-like repose for ages, while to-day the monthly pay-roll of men employed in these quarries goes into the thousands of dollars. There are also, inexhaustible beds of sandstone within a few miles of the city of San Jose, of a rich yellow color, and much used in trimmings with pressed brick, giving a very pleasing effect. There is, also, a beautiful gray sandstone found near Niles, and much used in our city. Besides beds of granite and sandstone, there is abundance of marble found in different parts of the State.

Before referring to the ingredients of which granite, sandstone and marble are composed, it may be interesting to speak of the points of chief interest in quarries.

First, they show us the mineral crusts of the earth-sands, converted into sandstone, muds into limestone or slate, and materials of which we know very little, into granite.

They show us the peculiar changes in position by which these materials, once at the bottom of deep water, have been placed in the order in which we now find them, or in other words, they illustrate the nature of forces that have lifted up the earth's crust.

They show us, very often, in a perfectly distinct manner that the original accumulation, now stone, was a succession of shelly beds or an alternation of shelly and impalpable mud, or a heap of sand followed by mud and shells. They enable us to measure in a rough and approximate way, the relative time required for the original deposit. They inform us of the change that has taken place in the arrangement of the animal and vegetable world since the present hard rock was deposited as soft mud. As to the material the different stones are made of, it is a study in itself, and a paper written on either one of them would indeed be interesting reading by one of our chapter on some future evening.

The construction of granite is peculiar; according to the definition of geologists, it is a mass of crystal, imbedded in a crystalline shape, the crystals being of two kinds, the mass being a third kind of mineral. The oblong flesh-colored crystals in common granite are called feldspar; the little, bright, flaky crystals are mica, and the mass in which they occur, often white or gray, is called quartz. Often the flaky crystals are not here, but in their stead are dark green crystals, so abundant as to color the mass; the granite is then called syenite. There are many other varieties, and the minerals are very differently arranged in different places. Geologists give different names to each different variety, but it is not necessary to trouble ourselves with these names here.

Next to granite we have mentioned sandstone. There are few parts of the world where sands do not appear in some form or other, and a few words about them may perhaps be interesting and amusing.

There is an old Greek story of Midas, who, when he found that his faculty of turning into gold everything he had touched proved inconvenient, was enabled to part with so dangerous a power by washing in the river Pactolus. The fable states that the sands of that river ever since contained golden particles, and if the story be true, it may be supposed that the representatives of Midas must have been widely spread over the earth in early times, since most other rivers are provided with similar rich sands.

Sandstones are generally made up of particles either of fine sand or very small rolled pebbles, these particles being in some way or other cemented together; certainly in some rocks there is no foreign substance cementing them, and they either simply adhere by close contact, which is possible, or

are fastened by a silicious paste. More usually the grains are cemented by something like mortar obtained naturally by the action of water containing lime and iron.

The color of sandstone varies chiefly according to the quantity of iron and marl they contain. All varieties of yellow and red are met with, and frequently the best and hardest kinds are of pure white and pale gray.

I wish I had sufficient time to say more on the "stone age." I would fain follow the tiny spring oozing out of the side of some mountain, and follow its course as it winds along until it becomes a rivulet, and with numerous tributaries becomes a mighty river, taking in its course particles of clay, sand and pebbles, until it rushes, with one mighty bound, into the bosom of the ocean, there intermingling with the shells of the briny deep, and again returning to the beach, there warned by the great Sovereign Architect of the Universe that proud waves shall be stayed—there shall it come and no further—rest for countless ages and turn to the material that it is our lot to convert into artistic homes for our fellowmen.

ANTEDATES THE INDIANS.

ABOUT five miles south of Goodlettsville, Tenn., is a large farm known as the Morrison Stratton farm. It is now owned by Capt. Andrew Dale, who was once a large lumber dealer on the Cumberland. Capt. Dale has been living on this farm for seven years. In a large grass lot near the house, last spring, the Captain noticed quite a number of rocks standing edgewise in the ground. To satisfy his curiosity he began to dig. He discovered at once that he had struck a rock vault, and in it he found a human skeleton. This led to further investigation and a great many of these vaults were found. Some of these vaults are not more than 4 and 4½ feet long. In them we found human bones and teeth, which undoubtedly represented a people low of stature but of good size for the height. For this reason Capt. Dale thinks that they represent a people that antedate the Indians. The skeletons are not more than a foot and a half from the surface of the earth. We can account for this by a process of erasion which has been going on perhaps for ages.

BEST THEY HAVE SEEN.

"Please send us STONE for one year, commencing with July number. It is the best journal of its kind we have seen.—*Byrne Bros., Lincoln, Cal.*"

THE GREATEST BUILDER OF ALL AGES.

RATHER more than 3000 years ago, says the *Pall Mall Budget*, Rameses II took in hand a mountain in Nubia, and hewed out of the living rock two vast temples. One is never surprised at anything Rameses did. He pervades the entire Nile and dominates everything right away from Cairo up to Wady Halfa. If you come across anything colossal in the way of building, anything overwhelming in design and successful in execution, you may be quite safe in putting it down to Rameses. He reigned over sixty years, begat 170 children and lived to be nearly 100 years old. And now he lies in his case at the Gizeh museum, the haughty old face frowning beneath its glass cover. Short work would he have made of the hundreds of tourists who pry and peep and giggle at his royal features. But of all the great things that he did, these temples at Aboo Simbel are the greatest. The larger of the two he dedicated to the god of gods, Amun, and secondarily to his own glory; and the smaller to the goddess Hathor and to his wife Nefertari. It is rare to find, either in tomb or temple, the record of conjugal love, but this smaller temple makes it clear that Rameses had a tender side to him. Half a foot deep in front of the temple he cut an inscription, setting forth that he "Rameses the Strong in Truth made this divine abode for his royal wife Nefertari, whom he loves;" and the queen herself, tenderly responsive, carves in undying words that she, "his royal wife, who loves him, built for him this abode in the mountain of pure waters." The better to study these temples and to see the engineering work in progress, I slept two nights in this veritable house of love.

But at the larger temple practical work is in hand. Here the four gigantic colossi sit, hands on knees and gaze across the desert sands. Three thousand years have told upon the cliffs above the temple. The statues themselves would have defied time, but the native rock has yielded to sun and sand. In the rock itself there is a treacherous vein of clay and the sand has at last eaten away the clay, and the fissures have gradually widened. A report was furnished to the irrigation department at Cairo, setting forth that the great temple was in eminent peril, and that a block of stone, weighing 270 tons, was likely to fall and smash the only one complete statue out of the four. One of the embarassing facts connected with the present Egyptian administration is, that nothing can be done without the consent of a half a dozen dominions and powers. Rameses himself, would have told off a thousand slaves and carted away the entire hilltop in a few weeks—he never allowed himself to be incumbered with red tape—but, under existing circumstances, Rameses has had to wait some months with the big block of stone impending over his head. Then the surveyor

sent a still more urgent report, and ultimately, Capt. Johnson, R. E., and twelve English soldiers were sent up to Aboo Simbel to save Rameses. They found no less than three rocks in a dangerous condition; one, measuring 34 by 12 feet, was taken in hand at once and broken into small pieces; another of 25 tons was similarly dealt with; and then the biggest of all, weighing about 270 tons, was tackled. No explosives of any kind could be used, as the two northernmost colossi are out of their equilibrium, and the least vibration might topple them over; so five stout iron cables were placed around the big block, and then it was broken up into small pieces and thrown down into the sand. Rameses may now sit in peace and watch the dawn break over the desert for another 3000 years. The two colossi which are out of balance are to be pinioned back to the rock behind by iron bands; the bands will be disguised as much as possible, but one regrets that a more dignified method of support for Pharaoh could not be devised.

THE THRONE OF TIMOUR.

MANY are the remains of ancient art whose origins seem to be lost past recovery in the mists of antiquity. In Southwestern Persia is a very remarkable work to which, without any apparent reason, the natives have given the name of Takht-I-Timur—"Throne of Timour." The work consists of a group of gigantic figures cut out of sold rock in a perpendicular ledge in the side of the mountain bordering the road. The central figure is that of a king, sitting on a lion for a throne, with his courtiers in reverential attitudes about him. The whole is surrounded by a high, massive wall on three sides, while the mountain, out of which the figures were cut, forms the fourth side. In the court thus formed are niches and cells now long abandoned to bats and hyenas. The figures are of an antiquity apparently much greater than that of the wall. The nobly enthroned monarch is said to be of a truly royal mien, and though the storms of ages have beaten upon the stone, the countenances of king and courtiers are said to be still expressive, and may have been portraits of men who flourished long before "Timour the Tartar.—*Helen B. Smith in American Agriculturist.*

AN ENORMOUS AEROLITE.

AN aerolite of enormous size is reported by the newspapers to have fallen into the Caspian Sea, not far from Apsheron. As it now lies it has, it is said, the appearance of an ordinary rock projecting over twelve feet above the level of the sea, which at this point is twenty-five feet deep. Its fall was accompanied by a loud noise, and the sea was greatly perturbed for a considerable distance.

CONGRATULATIONS.

WITH No. 1, of volume 5, STONE inaugurates many changes in form and mak-eup, which we unhesitatingly say makes it the most attractive trade paper published in the United States. In size it is 7 by 9 inches. It displays a new and tasteful head, and the paper is now a model of typographical beauty, mechanical skill and editorial judgment, which will be imitated largely by publishers of trade papers in the future. STONE, in its new dress, is a technical magazine. Editorially, mechanically and artistically it is entitled to claim rank with *Harpers*, *Scribners* and the *Century*. Its columns are filled with articles from the pens of some of the best authorities on matters pertinent to the subjects embraced within the prospectus of the journal, and many of them are illustrated by the very best photo-engravings.

We congratulate the publishers on the deserved prosperity which the improvements of their journal evidence, and hope it will not only continue but increase.—*The Journal of Building.*

Allow me to compliment you on the change you have made in STONE volume 5, No. 1. A great improvement over the old style.—*A. Woodard, Ph. D., Librarian American Museum of Natural History.*

Mr. A. Myers, President of the Credit Valley Quarries Company of Toronto, Canada, says: Let me congratulate you on your improvement of your new style of journal, commencing with volume 5, No. 1. (June number.) I must say that every quarry owner or quarry company should not hesitate to subscribe for your journal. I, for myself, must say that I would not be without it under any circumstances. It is full of good, practical and useful subjects that are of great advantage to all quarrymen and men engaged in the stone trade.

"Hugo truly said, 'succeed, for success presupposes capacity.' Your June number of STONE argues both success and capacity. From an artistic, typographical and literary standpoint, this number is unexcelled; therefore, you have my heartiest congratulations. The zeal you have shown in the past is a sufficient guarantee that the high standard you have set will be maintained in the future. I believe your journal has done more to benefit the stone trade than all other agencies combined. It deserves, and should have, the earnest support of every man engaged in the stone business.—*Sylvester Marshall, Pres. Nat. Ass'n of Quarry Owners.*"

FRICTION.

ONE of the unrelenting foes of force is friction; and were it not for that ever-present factor, motion would become as simple, as easy and as airy-like as are the motions of the planets, the nebula and other floating fragments through ethereal space, which meet with absolutely no frictional resistance when roaming apart from, and independent of each other.

Unfortunately, however, for the plodding mechanic who is ever trying to devise means for annulling the laws of friction here on this mundane sphere, all solid substances and some that are not solid, possess weight, have a specific gravity that demands a state of rest, and even the most cunning artifices of man cannot disturb that natural state of rest except by the application of force. Man may construct the most skillful of mechanical devices, hung or poised on the most delicate of centers, but they will remain perfectly still until force is applied to move them around, and when the force is reversed the natural state of rest is soon resumed. The natural laws of friction are opposed to motion and when the over-ruling force is removed, rest is ordered and rest ensues.

It is assumed and accepted as a fact among many practical as well as theoretical men, that the frictional resistance is in proportion to the weight of the moving object. That is true in a modified sense only. A revolving shaft for instance, weighing one ton, may require ten times the force to revolve it that it does another similar shaft weighing ten tons.

The most popular error, however, seems to be that friction is independent of time, surface and velocity. This is a newly-discussed error—but nevertheless popular. Time can never be ignored in any kind of a calculation, be it for overcoming frictional resistance or any other kind of mechanical or natural resistance. As we multiply times so do we increase aggregate resistance, and so must we multiply force to overcome it. Friction is independent of surface in a modified sense only. If it is meant to increase or spread the surface without increasing the weight, as for instance incasing a revolving shaft in a bearing its full length, instead of hanging it in two or more short bearings, there is no sensible increase of frictional resistance to revolving it provided the shaft is very perfectly turned and the bearing perfect. But if by surface is meant the space traveled over in a given time then the frictional resistance increases with the increase of surface or space. Thus, for instance if we draw our sleigh over a level piece of road at the rate of five miles an hour, and another of the same weight at the rate of 20 miles per hour, it will require four times as much force to move the latter as it will the former.

Friction is at no time, in no sense nor under any condition independent

of velocity, weight and bearing surfaces being always the same; every increase of velocity means an increase of frictional resistance that requires an increase of force to overcome. Every decrease of velocity means a decrease of frictional resistance and a decrease of force to overcome it.

All of these variations in the laws of friction were formerly well-known to all the leaders among mechanics and are yet, but errors will creep in notwithstanding. How to overcome or reduce friction has ever been a study among leading mechanics and many mechanical devices for the purpose have resulted. Also anti-friction metals for journal-boxes have been quite numerous. Anything to beat friction is the motto.

THE DRIFT OF LAKE CURRENTS.

DURING the next few months a great many bottles will be cast upon the shores of Lake Michigan. They are to be thrown into the water for experimental purposes by lake captains, who will undertake the service at the request of the United States Government. The experiments are to be conducted for the purpose of determining the set and drift of lake currents, and will be under the direction of the weather bureau. The bottles are to be given out to vessel captains, who will agree to throw them overboard and enter certain data on blanks furnished for that purpose. In order to do the work systematically, the great lakes have been mapped out in numbered sections, commencing at Duluth and numbering eastward. There are 410 sections in all, each containing about 180 square miles. When the captain throws one of the bottles in the water, he will place in it, before so doing, a slip of paper, upon which the data and the position of the vessel is entered. On each slip is the request that the finder send it to the chief of the weather bureau at Washington or hand it to the nearest government observer, light-house keeper or postmaster, to be forwarded. By noting where the bottles go ashore, data will be obtained from which the movement of the lake currents can be calculated.

A FLAW IN THE METHOD OF TESTING STONE.

AN exceedingly valuable paper on the building stones of Great Britain by Prof. T. Hudson Beare, appears among the latest batch of publications issued by the English Institution of Civil Engineers. He gives the results of very exhaustive crushing, absorption and elasticity tests carried out at University College, London, on specimens of stone from representative quarries in Great Britain, and he says that it is his intention to follow these up with experiments on building stones from all parts of the world. The tables will be of the greatest value to English engineers and architects, as the standard compilation hitherto used is getting out of date. This old compilation was made in 1839 by the British Government for the purpose of selecting the most suitable stone for the new Houses of Parliament, and curiously enough, after having gone to this trouble and expense, they chose a dolomite, which has proved incapable of resisting the attacks of the atmosphere in London.

The majority of the granites tested, naturally came from the neighborhood of Aberdeen. The Scotch say that there is enough granite round Aberdeen to supply a handsome tombstone for every inhabitant in England, and they would very much like to fulfill the contract at once. The crushing load of this granite averages 1,250 tons (of 2,240 lbs.) to the square foot but some fields yield granites whose crushing strength is from 1,320-1,360 tons. The sandstones of Halifax, Yorkshire, gave a mean crushing load of 1,025 tons per square foot. We hoped to see some facts with regard to the granites and serpentines of Donegal, Ireland, but they are not mentioned in the paper at all. On the west coast of Ireland there are mountains of excellent granite and magnificient serpentines waiting for somebody to work them.

An interesting point in the testing of materials, is brought out in the report. It has been hitherto, a common practice to interpose a sheet of lead or thin pieces of wood between the piece of stone to be crushed and the dies of the testing machine. The idea is, of course, that this arrangement would secure a perfectly uniform pressure all over the cube in consequence of the lead or wood yielding and accommodating itself to the inequalities of the surface of the stone. Professor Beare's experiments, however, showed that the introduction of lead or wood very largely reduces the crushing strength of the specimen. This he explains as follows: The compressive forces produce lateral dilatation, and consequently a tension at right angles to the line of pressure; now under the great pressure in the testing ma-

chine the lead flows laterally, and the friction thus caused between it and the face of the cube sets up a very considerable additional tensile stress, the result being that the cube is torn asunder into a series of prisms parallel to the axis of pressure. In some experiments he conducted with cubes of stone, with and without the lead sheets, it was found that their presence reduced these crushing strengths by from 35-52 per cent.

A DECISION ON TRADEMARKS.

SEVERAL weeks ago the Cleveland Stone Company asked the United States Circuit Court to issue an injunction, preventing John Wallace and others from selling, or offering for sale, scythes, whetstones, etc., bearing the same name and trademark as those manufactured by the complainant. Judge Swan has decided in favor of the company. In his opinion he says that while competition is a perfectly legitimate feature of trade, it is not to be permitted that one dealer sell his wares with a brand fashioned after those of a competing dealer, or imitating them so closely that the public is deceived into buying the goods, believing them to be those of the other dealer.

In this case it had been claimed by the defendants that their goods were equal to those of the complainant. Judge Swan held that where a party feels himself aggrieved, and sues for redress, two things are to be considered —the injury done the public, and that done to the aggrieved party. If the public gets an equally meritorious article under a false trademark, it is not aggrieved, but the injury done the dealer is the greater, as the trade secured by the offender through imitating its stamps is likely to be permanent and cause loss to the aggrieved; whereas, if the article sold was inferior, the trade secured by its misrepresentation would be ephemeral.

EFFECT OF TIME ON STRENGTH OF CEMENTS.

IT is best to test cement briquettes at least thirty days after their manufacture. Baron de Rochmont, engineer to the Port of Havre, gives figures to show that the strongest briquettes, at two days, having a breaking strain of 147 pounds to the square inch, had a breaking strain of 318 pounds per square inch. Other cements which had breaking strains of 157 pounds at two days increased to 661 pounds in thirty days. The weight and tensil strength of cements diminish when they have been kept in stock for some time. In the case of 15 cargoes of cement which came under his notice the weights, on delivery, were between 111 and 121 pounds per bushel, and the

breaking strains were from 75 to 160 pounds per square inch in two days, 160 to 289 pounds in five days, and 339 to 460 pounds in thirty days. After being six months in store their weights were from 101 to 108 pounds, and their breaking strains from 38 to 114 pounds in two days, 112 to 195 pounds in five days, and 234 to 340 pounds in thirty days. The fall in weight and strength when the cement has been kept in store for a year is still greater. One cargo weighed on delivery 111 pounds per bushel, and its breaking strains at two, five and thirty days were 96, 236 and 371 pounds respectively. After the cement had been in store six months its weight was 106 pounds per bushel, and the briquettes made from it had breaking strains at two, five and thirty days of 109, 178 and 332 pounds respectively. After being in store a year the cement weighed 106 pounds per bushel, and the briquettes made from it had breaking strains at five and thirty days of 73 and 250 pounds respectively.

A STONE LONG LOST.

DURING the first twelve years of work on the Washington monument at the national capital, memorial stones were sent from all quarters of the globe to be laid on the inner wall of the shaft. In 1853 there was received from Pope Pius IX a polished slab of marble, bearing the simple inscription, "Rome to America." On the morning of March 5, 1854, the stone shed at the foot of the monument was found broken open and the Pope's gift was found missing. The Knownothing agitation was at its height at this period, and some of that organization were believed to have made way with the slab, but nothing was ever proved. Now comes this interesting sequel: A Washington paper on Sunday printed a story to the effect that a large fragment of a polished marble slab had just been found by a diver employed in the construction of new piers for the northern section of Long Bridge, connecting the District of Columbia with Virginia. There are only four letters missing and as the rest correspond to those on the Pope's slab, the fragment is believed to be a portion of the long lost stone.

A PREHISTORIC MEMORIAL.

IT is reported that an effort will be made to exhibit at the world's fair the famous onyx stone found in one of the old mines on Onyx mountain, in Durango, Mexico. The concessions granted by the government to the party of American capitalists included all mineral land in the mountain, and

this stone, which has been left where it was found several years ago, is now the property of the syndicate. They have made arrangements for shipping it to Chicago some time this fall. The stone is oblong in shape, being seven by three feet in dimensions and is very beautiful. It is carved with hieroglyphics and is evidently a memorial or sacrificial stone, for the workmanship indicates that it was done by the best artists of the time when it was quarried out. On the top is the figure of a man in bas-relief, surrounded by scroll-work and hieroglyphics, and at the feet of this figure lie several figures of nude children. The figure of the man is life size and the face is most exquisitely carved, while at the upper right corner is the figure of a blazing sun. The man has a child in one hand, while he holds a knife in the other and he looks toward the sun.

Only two of the sides are finished. These are decorated with scroll-work in the shape of vines, which twine around columns carved in relief in the onyx. The veining of the stone is of four colors and runs in layers horizontally, so that the top carving is in the nature of cameo work, while the sides are crossed with veining. At the upper end is an elevated place, while just above it are depressions, as if made to fit the head and neck of a person lying on the stone, while the figure of the man is in such a position that the victim would be compelled to lie on the carved surface, and consequently it is supposed by some to be a memorial stone.

POORER, BUT KNOWS MORE.

THE Quincy (Mass.) *Ledger* says: Fred J. Fuller, one of Quincy's granite manufacturers, is just $100 poorer than he was some ten days ago, but he has gained that amount of experience. On the day in question a well-dressed stranger, with an oily tongue, visited his office and said his name was C. S. Preston, and that he represented Brennard & Co., contractors at Sing Sing. Mr. Fuller had done business with that firm for a number of years, and the stranger was extended the right hand of fellowship. Preston was looking for some stone, and before he left he bought all Mr. Fuller had on hand, which amounted to something like $1,000.

The two had quite a social chat, during which Preston showed that he was well posted on former business transactions between Brennard & Co. and Mr. Fuller. He said he was anxious to get back to Boston before the banks closed as he had a check for $100 which he wished to get cashed, as he wanted some money to use. Mr. Fuller said he did not think it possible to get into town before the banks closed, and, as he had not quite completed the present transaction, he said he would fix that all right. The

business completed, Preston was driven to the National Granite bank where he presented his check. Mr. Claflin said he was not in the habit of cashing New York checks, but if Mr. Fuller said it was all right, and would indorse it, he would cash it.

This Mr. Fuller did, and Preston, taking his $100, departed. Many days did not elapse before it was discovered tbat the check was a forgery, and that Mr. Fuller was out $100. It was also learned that Preston was, at one time, a convict at Sing Sing, and while there acted as bookkeeper for Brennard Co., which was how he gained his knowledge of former transactions.

USES OF GROUND MICA.

GROUND mica is coming into use in such a variety of ways, and so many new uses are constantly being found for it, that the supply is in danger of becoming inadequate. There are considerable difficulties to be overcome in grinding it, and there are only two or three firms engaged in the business at present. A London paper describes eight standard grades. The coarsest of these are used to give frosted and spangled effects to the fancy grades of wall paper. The medium grades are employed in the manufacture of a lubricant for the journals of railway carriages, for heavy bearings generally, and for the axles of road vehicles. The finest grades are used in producing a uniform metallic white surface on wall paper. Scrap mica for grinding must be white and as free from specks or colored matter as possible, since any impurities in the scrap will affect the color and luster of the product. There is considerable consumption of sheet mica on the part of the manufacturers of electrical machinery and likewise for stove purposes. The higher grade micas are used for the latter purpose. The lower grade micas are used by the electrical manufacturers.

A NEW PAVING MATERIAL.

EXPERIMENTS in the material and methods of street paving have been and continue to be so numerous that unless fortune is strangely perverse it would seem inevitable that the right combination must be hit upon at last. What is called adamant stone is a recent invention in England and is said to possess superior merit in respect of density and resistance to pressure. It is also frost-proof, a quality even more important in this country than in England. Whether it is capable of long service remains to be ascertained. It is composed of finely-crushed Aberdeen granite and Portland cement, two parts of the former to one of the latter, mixed with water and molded under powerful hydraulic pressure.

EDITORIAL COMMENT.

CONSIDERABLE discussion, that in some ways has taken an acrimonious turn, is rife over the Indiana soldiers' monument, now nearly completed. It was the purpose of the commission to memorialize the military history of Indiana, from the early struggles with the British and Indians, the Mexican war to the later civil war, that by its colossal proportions has tended to obscure the more homely but not less heroic services of the antedating period. There is a sort of unconscious effort by many to begin the history of the country with the civil war, but this feeling, while perhaps natural to those who, then young, were actors in the stirring drama, that they would memorialize in the monument, only proves the necessity for some means of expressing the memories of those events that were a means, and the principal means, of securing the empire of the Mississippi valley and the Southwest from possession by foreign powers. In truth the memory only lingers as the misty recollections of the aged, or is read about by the young generation with the same vagueness of mental impression that one reads of the wanderings of Ulysses, or the adventures of Captain John Smith. And it is not only proper, but it should be imperative, that this monument to the military prowess of Indiana should perpetuate the heroic events that as much belong to it as the more recent ones of the civil war. There should be no conflict of mere pride in the memorial, and the accessories of the monument emblematic of the varied events should be such as to keep alive memories that seem to be fading from the minds of the present generation, while in no way subtracting from the glory of the later achievements.

THERE is but little change visible at this date in the granite strike, although there were some rumors of compromise. Both sides have made some gains—the boycott of paving material in New York having failed, while on the other hand several large granite quarries have resumed operations under union auspices. In a general sense the trade is paralyzed, and a great impetus is being given to the import supply. But at present this event is overshadowed by the Homestead incident and the still more lawless one in Idaho. Altogether these incidents bring the whole question of relations between employers and employed in the strongest light, and they serve to strengthen a

necessity for some means to eliminate the condition of potential and actual war that is now chronic, and seems to be increasingly more destructive. The differences measured as a wage question in all the cases are too slight for consideration, and both sides seem to be fighting for what each regards as a sacred principle. One side proclaims its right to run its own business in its own way—and the other side makes exactly the same claim. As a real fact each has an interest in the other and both should have some grounds for enforcing some sort of responsibility on the acts of each other. But the law does not contemplate the responsibility of men except as individuals, and therefore the guilds of employers and employed are fighting it out for themselves in the good old-fashioned way.

WHEN two individuals fail to agree, they may take their grievances to the courts for arbitration. But when two trusts of labor and capital fail to agree, the law refuses to recognize the right of either. It may be that these disturbances, like the plagues of Egyyt, will lead to such modifications of the law as will fit it to cope with the conditions of the latter half of the Nineteenth century. The common law and the precedents belong to the past, and are the legacy of former revolutions and in their day represented the general conception of progress of an epoch. The American constitution was admirably fitted for the conditions of the first half of the century. But since then society has undergone a complete revolution, and the only efforts of law-makers has been to stay its progress, but without the least success. The trades union is an unconscious, but spontaneous effort to minimize the evils of fierce competition, and the laws, instead of directing the movement, have sought to render it illegal, by conspiracy and other acts. The syndicate, trust or bonded form of producing capital, has formed combinations, "frozen out" small rivals, limited output, and arbitrarily set prices in defiance of the alleged "law" of supply and demand. In short labor and capital have unconsciously done an identical thing, for an identical purpose, and a purpose, too, that is in all ways conservative, and for the greatest good to their own interests, and to society as a unit. But the law proclaims this all to be illegal, and that all of the moral ethics are contained in the *lassiez faire* (every man for himself) in spite of the fact that the ponderous energies of modern civilization cannot exist on such a status, but requires instead community of interest.

WE hear a great deal about the abnormal growth of a wealthy class, and the increasing poverty of the masses. This is the reverse of the truth. This country has several enterprises on hands so huge in its requirements that even such private fortunes as the Goulds' or Vanderbilts' are totally inadequate, and only by a combination of many capitalists can such an enterprise as the Nicaraguan canal be fostered. The laborer, no longer master of a little shop, owning his own tools, and contracting his own labor as an individual capable of refusing, is hived in vast gangs, working with tools owned by the employer, and can only preserve his individual independence by aggregating it into a huge corporation. It is true that individual wealth has increased, but almost in the same degree the comfort, luxury and holdings of the masses have increased. All classes have made great positive advances, and it is only in the relative sense that the same

disparity is seen. Workingmen, by combining in building and loan associations have in that measure freed themselves from dependence upon the money loaning class, and in a certain sense have become their own bankers. In many ways they are carrying their own insurance. If the money spent in destructive strikes were put into a capital, it would not take long for men to become their own employers. But it requires organization, disciplining and respect at least for the authority of their own creating.

THESE are conditions, not theories, and men are seeking to unravel the problem of how to accommodate themselves to them. We have four political parties—two of them relics of the past, with traditions that do not accommodate to the present. Another so-called "people's party," has notions of something out of joint, but misty and vague as a morning fog of how or wherefore. The other, the prohibition party, with a recipe for the moral regeneration of saints only, and purely millennial. Meantime, events march by, with more or less dead and wounded, with anarchy of law and anarchy of motive in the background. The two powerful entities, organized capital, and organized labor, that should, for each other's benefit form a partnership, have declared a war for their extinction.

THE law must recognize the fact, and must establish a code of equity for the government of men who have merged their individuality into an organization. The higher law does not relinquish its power to regulate how far one may "manage his own in his own way." There is no equity in allowlng men the privilege to do as they please with their own if such liberty is subversive to another, or to society. The *absurdo ad absurdum* would be quickly recognized if a man were to assume that because he owned a house, he has a right to burn it down, or to blow it up. Yet the same assertion of privilege by a trust or a trades union, that is greatly more destructive and far reaching, is viewed with doubt. There is no reason that the law, in cases where the two elements cannot reach a peaceable or equitable solution of their difficulties, should not make one for them, precisely as it does between individuals. The real issue is involved in an assertion on the part of the labor classes for a legal recognition of a property value in labor, and it is one that has difficulties to a society loaded down with precedents of servile feudalism and slavery that the world has hardly yet outgrown.

SOMETHING on this line of march is the current agitation among architects to do away with time-honored custom of taking employment through "architectural competitions." Mr. Inskip, at a recent meeting of the Victorian Institute of Architects, calls them "an invitation to architects to see who can tell the greatest lie upon paper." The injustice of the custom is grosly apparent, when out of a competition where fifty or more sets of drawings are submitted, only one can be successful, and the labor and pains of the other forty-nine go for nothing. The custom grew out of a healthy rivalry for preëminence in high art, and if the habit were confined to such it would be stimulating to the artistic creative impulses. But out of the fifty drawings it is seldom that the best design is accepted. More often it is the one that combines the showiest proportions with the greatest cheapness of construction—a competition for cheaps and cheating. The evil is so ingrained in habit that it is not clear how

it can be eradicated, or even modified, ingrained, as it is with machine made artists, and the callowness of "schools of design," and other manufactories of mediocrity. A piece of high art, where expression and quality is not subordinated to expense, and where, indeed, an artist may produce a monument to his own genius, should be an occasion for hearty emulation. But these are so rare that they need scarcely be considered where the ignoble instinct of greed salvation is the only inspiration.

Architects are considering another question, more germane to America, in criticising the method pursued by the Treasury Department in the letting and construction of American buildings. Last year over three hundred buildings, most of them pretentious, were presumptively designed and superintended by the supervising architect. A bill is before congress to place this work out to the profession, and the report of the committee in charge of the bill clearly showed that the burden of work laid upon the supervising architect is beyond the power of any one man. The *Architectural Era* well says: "Where the pressure of work is so enormous and the force of draughtsmen inadequately directed, short cuts to results will be inevitable. The last new building in North Dakota is made to do duty for the next new one in Florida, regardless, as the committee declares, of local differences of climate or space requirements. Such a system is also necessarily cumbersome and uneconomical. It takes government from three to five times as long to build as it does the private citizen or corporation, and costs about twice as much. A notable case is cited in the report, of the Detroit building, "where the construction was authorized eleven years ago, and $1,300,000 therefor has been appropriated by congress years since, and the foundation walls are not yet completed."

Says a writer in the Chicago *Herald*: "Since a cemetery must of necessity be conventional and few monuments or gravestones depart from some well-known and often repeated pattern, it seems right that such conventionality should be subordinate to a general plan which should combine all detail in one fair and noble conception of satisfying and restful beauty; so that a burial ground ought to be endeared to us, not only by the memory of those who sleep there, but by the grand group of trees, the well-considered arrangement of shrubs and flowers appropriate to the scene, which would give to the ground a dignity and impressiveness forever to be associated in men's minds with those they have loved and lost." And this is true. But must a cemetery of necessity be so conventional that all creative fancy is cut in to an extreme of gloomy monotony? It must until the popular idea of death and the hereafter changes, as gradually it is doing. It is because it has become a conventional taste to regard the whole subject with a spirit of gloom, rather than of hope, that all cemetery decoration has been made conventional, stiff and monotonous. It is the mere association of habit that accepts nothing as fit for a cemetery that does not conform to the severe lines laid down by a medieval mysticism, and dares not use the forms of beauty and harmony that nature supplies in all her moods. The ancients did better, the mausolea of Ionian Greeks, the cinirary memorials of Rome, and even the later necrological art of Paris, are examples where the cemetery is freed from the monotony that has become conventional in America."

THE ASSOCIATIONS.

THE INDIANA DEALERS.

THE semi-annual meeting of the Indiana Marble and Granite Dealers' Association was held at Eagle Lake Hotel, Spring Fountain Park, near Warsaw, on the 9th, 10th and 11th inst. There were present about 30 dealers and representatives of wholesale firms. Most of those present arrived at the park on Saturday, the 9th, and greatly enjoyed themselves at the pleasant resort, the weather during each day of the meeting being perfect for out-door recreation. Many of the visitors brought their wives and daughters along, and the presence of the ladies contributed largely to the great enjoyment of the occasion.

On Monday, the business meeting of the association was held in the hotel, being called to order by President Ohaver about 11 o'clock.

This meeting being more of a social affair than one of business, reports of officers and committees were not called for.

President Ohaver appointed at the last meeting as delegate to the conference at Quincy, Mass., in April last, recited his experience, and outlined what that conference had submitted as a basis for the formation of a national association. The secretary read the constitution and by-laws, formulated at Quincy, and submitted for adoption to the various state and local associations.

Mr. Leavenworth moved approval of document, which motion was discussed at length; and was then withdrawn, and a substitute motion prevailed, referring the matter to a committee of three to report at the next regular meeting.

President appointed as such committee Messrs. Cochrane, Powell and Doty.

Mr. N. P. Doty was selected as a delegate to the next convention of the national association.

Mr. John Ohaver was selected as a delegate to the next national convention.

The applications for membership of Alfred Boothroyd, of Delphi, of S. C. Carson & Co., of North Manchester, and Geo. B. Reichert, of Warsaw, were presented and the applicants were duly elected.

Adjourned till 1 P. M.

AFTERNOON SESSION.

Re-assembled at 1 P. M. A general discussion of the purposes of and advantages in an alliance with the proposed national association was indulged in. The consensus of opinion on the "Quincy Question," which in brief is that dealers shall place their orders for monumental stock with the producers direct, and thus eliminate from the trade what are now known as middle-men, was against the proposition.

Applications for membership of H. D. Pontius, Silver Lake, H. T. Sarber, Warsaw, and John T. Greer, of Bourbon, were presented, and the applicants elected.

There being no further business before the convention, on motion an adjournment was taken to the regular annual meeting in January next, time and place to be hereafter announced.

THE OHIO ASSOCIATION.

The Granite and Marble Dealers' Association of Ohio, met in regular semi-annual session at Toledo, Ohio, on July 12. The meeting was called to order at 11 a. m. in one of the reading rooms of the Boody House, by G. B. Eckhardt, Vice-President, in the absence of President Jones. About forty dealers were present.

On motion of I. H. Kelley the meeting was adjourned to 2 p. m.

THE AFTERNOON SESSION

was presided over by Vice-President Eckhardt who, in a neat speech welcomed the members and expressed satisfaction at the generous attendance. The minutes of the previous meeting were read and approved.

On motion Ira P. Rowley, representing STONE, was made secretary *pro tem.*

Moved by C. G. Leavenworth and seconded that all visiting dealers be extended the privilege of membership during this session. Carried.

Secretary I. H. Kelley, read his semi-annual report which was referred to an auditing committee consisting of John H. Lloyd, C. L. Batchelder and John Cochrane.

The committee appointed to represent the Ohio Association at the meeting of the National Association held for the purpose of revising the constitution and by-laws, made its report which provoked a lengthy discussion.

Upon request of Frederick P. Bagley, Secretary Kelley outlined the purposes of the constitution as revised.

Motion by Mr. Douglas that the constitution and by-laws of the National Association be indorsed as a whole. Amendment by Mr. Leavenworth that it be referred to a committee and that printed copies be sent to members. Carried. Amendment that committee be appointed to report at 8 p. m. Amendment adopted and motion carried. The following were appointed on the committee: Jed Williams, F. P. Bagley and John H. Lloyd.

A letter signed by James G. Batterson, Jr., preferring charges against W. H. Perry for breach of faith with the New England Association in violating the agreement relating to labor troubles was read and after an exhaustive discussion during which a committee was appointed and subsequently discharged, a motion by Mr. Lloyd prevailed, which provided that the letter be referred back to the sender with the information that the matter as presented, did not come under the jurisdiction of the association as a body and that charges must be made by a member.

Written charges were then made by Hugh Jones, and same ordered placed on file. The following resolution was read and adopted.

Resolved: That this convention of the Marble and Granite Dealers' Association of Ohio tender their sympathy to the members of the New England Granite Manufacturers' Association by the following vote, that the members of this association hereby agree not to buy any work or material of any firm that has been justly expelled or worked against the interest of the members of the Granite Manufacturers' Association of New England.

Application of J. B. Weber for membership was read and accepted Adjourned until 7:30 P. M.

EVENING SESSION.

Meeting called to order at 7:30. Vice-President Eckhardt in the chair. Secretary read his report of delinquences.

On motion of Mr. Bagley the secretary was given *carte blanche* in the matter of proceeding with the collection of them. Report of auditing committee read and accepted. Letters of regret from R. J. Haight, of the Monumental News and Chas. Wege of Columbus, were read.

Written charges were preferred by the Vermont Granite Co., of Lima, O., against Chas. Clements & Co., of Boston for "unjustly placing them upon a so-called confidential record."

Referred to the following committee: W. A. Harsha, G. A. Douglas and Isaac DeBow.

Committee on constitution of the National Association made its report, recommending its adoption.

F. P. Bagley, a member of the committee made a minority report, stating a number of objections to the constitution as submitted.

Motion by Mr. Kelley that the committee report be reduced to writing and spread on the records. Carried.

A committee on nominations consisting of R. A. Douglas, C. S. Batchelder and C. G. Leavenworth submitted the following list:

President—Chas. Briggs.

First Vice-President—Geo. B. Eckhardt.

Second Vice-President—W. A. Harsha.

Third Vice-President—Jed. Williams.

Fourth Vice-President—F. W. Underhill.

Directors: Jos. Carrabelli, Geo. A. Douglas, J. W. Willard, M. R. Jones, C. G. Leavenworth, Chas. Briggs I. H Kelley, Chas. L. Batchelerd and F. P. Bagley.

The report was adopted and the gentlemen elected unanimously.

Motion by Mr. Douglas that salary of secretary be increased to $200. Carried.

Request of Huntin & Co. for withdrawal card read and granted.

R. Burrell wrote of his desire to continue a member and related untoward circumstances. Motion by C. G. Leavenworth that Mr. Burrell's dues for the ensuing year be remitted. Carried.

Moved by Mr. Kelley that next meeting be held at Columbus the third Wednesday of January 1893. Carried.

On motion of Mr. Stuart a vote of thanks was tendered Ira P. Rowley, representing STONE, for officiating as secretary.

Motion made and carried that I. H. Kelley act as delegate to the National Association. Carried.

Adjourned.

IRA P. ROWLEY, *Sec. pro tem.*

CHIPS SWEPT UP.

The meeting was enlivened by some very spirited discussions and the evening session was prolonged until nearly midnight.

The wholesaler was there but was merciful to the dealer and instead of talking "shop" added considerably to his pleasure.

The trip to Put-in-Bay was well timed as there was a large concourse of people there and extra attractions augmented by banjo selections by "Billy Rice," yclept, Al. Snoots, and "high and lofty" tumbling by the irrepressible Leavenworth.

The banquet at Memorial Hall in the evening was a thoroughly enjoyable affair and attended largely by ladies. I. H. Kelley acted as Toast Master and the following toasts were responded to:

"The Indiana Association"—John Ohaver.

"Ups and Downs of the Wholesaler"—C. G. Leavenworth.

"Amalgamation"—Thomas Burke.

"Broken Vermicelli—or How I Escaped"—Al. Snoots.

"The Future of Our Association"—Briggs.

"Pushing the Button; or How to Remain Poor While Riches Are Being Thrust upon You"—John H. Lloyd.

"Guardian Angels by Gaslight"—I. H. Kelley.

"The Ladies"—Ira P. Rowley.

THE COMING MICHIGAN MEETING.

Mr. C. S. Harris, secretary of the Michigan Marble and Granite Dealers' Association, makes the following announcement for the coming meeting:

The summer meeting of the Michigan Marble and Granite Dealers' Association will be held at Jackson, Mich., on Wednesday, August 3d, 1892. The meeting will be called to order at 10 o'clock, A. M.

Our committee has secured reduced rates at the New Hurd House, where the meeting will be held. This hotel is one of the best in the State, and the managers will spare no pains to make our stay as pleasant as possible.

Jackson offers many inducements to visitors in the way of sight-seeing. It is a busy manufacturing city, with broad, clean and well-shaded avenues and beautiful parks, and chief among its many places of interest is the State Prison, and arrangements have been made to show those attending the meeting through the different departments without expense.

It is expected that this meeting will be of profit to all dealers in the marble and granite business who will attend the meeting, whether members of the association or not. To those who are not members of the association, we are positive that we can do you good if you will join us.

Come together and get acquainted with your competitors, and you will find them not near as "bad men" as you supposed. Our aim is that all members shall do an honorable and upright business; and by organization, we claim that we can compel one another to do so. Using unfair means to secure sales, slandering competitors, misrepresenting a competitor's work, are some of the things that we aim to do away with. If any member thinks that another is not living up to the requirements of the constitution and by-laws, come to the meeting and report it to the association. Come together and talk over your grievances and you can possibly come to an understanding that will be profitable to all.

We are young yet, but are growing in strength. The three meetings that we have held have been profitable to all who have attended them. One of the important features of the meeting will be a report, by President Philo Truesdell, of Port Huron, of the action of the National Marble and Granite Dealers' Association of the United States and Canada, which met at Quincy, Mass., on April 20th, last. The relations existing between the wholesale and retail dealers, and measures to improve the mutual interests of both, will be discussed.

The matter of bringing a bill before the next legislature, for the better protection of marble and granite dealers in the State will be brought before the meeting. At the last meeting of

the association, subjects on which papers were to be read, were announced, and will be responded to as follows: Foundations, Chas. Schmidt, of Grand Rapids; Agents, M. C. Barney, of Flint; Grievances, Philo Truesdell, of Port Huron; Letting Work, Thomas Harvey, Lansing; Granite, M. B. Burk, Mansfield, Ohio; Marbles, F. F. Murdock, of St. Johns; White Bronze, David Scott, Pontiac; Bases for Monuments, Alex. Matterson, Grand Rapids; Competition, C. W. Hills, Jackson; Trade Journals, R. G. Haight, Chicago.

To those who are perfectly satisfied with the way the trade has used them, we say, "come out" and tell us about it.

To those who do not think they are being used right, we say, "come out" and let us talk it over, and see if we can not come to an understanding and do better.

To those who are not members of the association, we say, "come out" and see if there is not some good we can do you if you join hands with us.

It has been the intention of the association, that every dealer in the State should have a copy of our constitution and by-laws. If there is any dealer who has not a copy, if they will notify the secretary of the fact, he will receive a copy by return mail.

Respectfully,
C. S. HARRIS, Sec. and Treas.,
Lansing, Mich.

THE NATIONAL ASSOCIATION.

President James Harsha, of the National Granite and Marble Manufacturers' and Dealers' Association of the United States and Canada, has issued the following circular:

CIRCLEVILLE, O., June 16, 1892.

To the Officers and Members of the State and Local Associations of Granite and Marble Dealers.

GENTLEMEN: Your several associations will be informed through the efforts of the secretary of the National Association of what was accomplished at the meeting of delegates held in Quincy, Mass., April 20, 1892.

The National Association will consider the work done at its next regular meeting, and will ratify and adopt or reject the same, depending largely upon the acceptance of local and state associations of the propositions presented.

Each state or local association to which these propositions may come is earnestly requested to take immediate action thereon, and notify the secretary of the National Association of the result thereof, and if accepted to appoint a delegate to represent them in the next assembly of the National Association which will convene in accordance with the provision of the constitution, of which due notice will be given indicating time and place of meeting.

The "ball is rolling" and we are on the right road to success, but it requires time, labor and patience to obtain all that best suits all parties concerned. The time is not far distant when there will be a compact which will unite the manifold interests of the granite and marble manufacturers and dealers that will so bind us together as one great element working for the right and the good of all in the trade who are doing business on fair, legitimate principles. The grand motto of "Doing unto others as you would wish them do unto you" will benefit the wholesale dealers, the manufacturers and the retail dealers.

Fraternally yours, JAMES HARSHA,
President National Association.

NOTES.

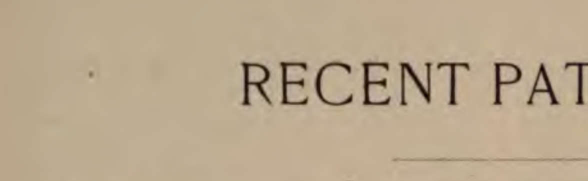
O. P. Snyder, secretary of the Colorado Stone Dealers' and Contractors' Association, writing to us from Denver, says that at a meeting of the Stone Dealers' and Contractors' Association, June 25th, they passed a resolution appropriating $100 for the entertainment of the Stone Cutters' Central Union of the United States and Canada when they meet in Denver in August. They also appropriated $150 to the fund for aiding the interest of stone pavement in Denver.

Jas. F. Brennan, secretary of the Marble Dealers' Association of New England and the Provinces, announces that the committee of arrangements, selected at the annual meeting in January, consisting of Frank H. Torrey, Charles Clements, John D. Allan, James F. Brennan and George E. Merrill, met at Boston, June 15th, to arrange for the semi-annual meeting of the association, which will occur Wednesday, July 27th. Downer Landing, outside of Boston Harbor, is selected as the place and attractive details are being arranged. The meetings of the association have obtained a reputation among the trade, and this one promises to be fully up to the standard.

W. E Emery, secretary of the Missouri Valley Cut-Stone Contractors' and Quarrymen's Association, announces that the semi-annual meeting will be held on Tuesday, July 19, at 10 o'clock A. M., at the Sherman House, Chicago, Ill.

RECENT PATENTS.

No. 473,725 is the invention of E. A. Booth, of San Francisco, Cal., and relates to an ore and rock crusher. The combination consists of a stationary jaw, the upper movable jaw, which is fulcrumed above its crushing face, the lower



movable jaw, which is fulcrumed below its crushing face, the actuating shaft eccentric thereon, a pitman which receives its motion from said eccentric, a connecting toggle between the pitman and the upper jaw, a link pivoted to the lower end of the pitman, and an extension or lever upon the lower jaw, to the end of which extension the lower end of said link is pivoted. The two jaws E and F, the eccentric T, are fixed to driving-shaft I, and the link or pitman M′ actuated by said eccentric and transmitting its motion through lever F^2 to the lower jaw F, pivoted to below its crushing face, so as to produce alternate and approximately continuous crushing movement of jaws E and F and divide the strain upon eccentric-shaft, together with the abutment or end member C.

No. 474,084 is a patent for an insertible tooth for diamond saws, and is the invention of Henry Forster, of New York, N. Y., and was filed April 3, 1891. It relates to an imp-oved insertible diamond tooth for stone-saws, by which the diamonds are held in a permanent and reliable manner in the tooth or bit without being liable to get loose, while the saw-blade is protected against too rapid wear by the hard metal material of which the teeth or bits are formed; and the invention consists of an insertible tooth for diamond saws, which is riveted or otherwise fastened into a recess of the saw blade and made of cast-steel or other hard metal and of greater thickness than the saw-blade, said tooth or bit being provided with soft-metal grooved edge pieces, by which the tooth is fitted to the tapered edges of the recess of the saw-blade. In the accompanying drawings, Fig. 1 represents a side elevation of a saw-blade with the improved insertible diamond tooth; and Fig. 2 is a horizontal section on line 2 2, Fig. 1. A in the cut represents a saw-blade, and B an insertible saw-tooth or bit, which is set into a recess of the blade A and fitted by means of grooved edge strips *b b* to the beveled edges of the recess of the saw-

FIG. 1

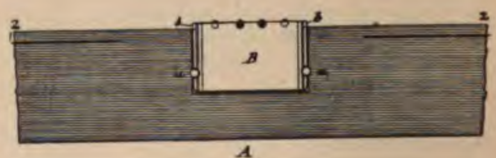
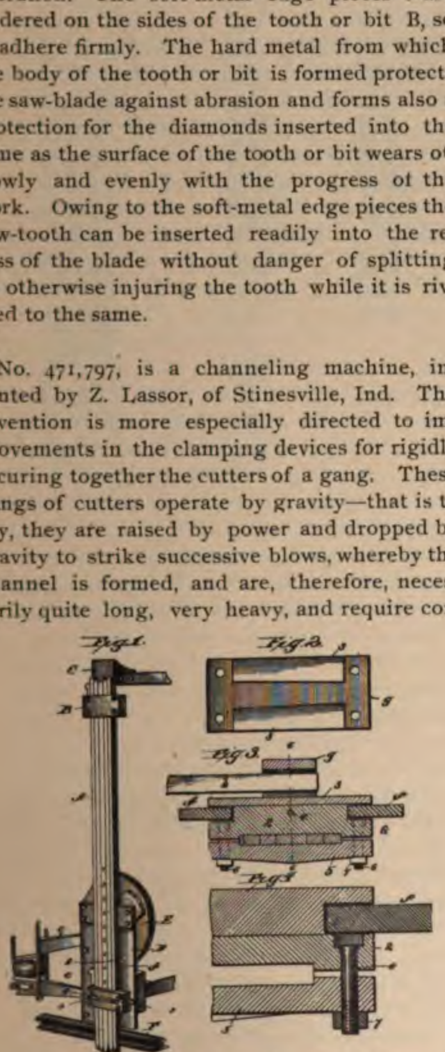


FIG. 2

blade. The tooth B is fastened by transverse rivets, keys, or other suitable fastening devices *a* to the blade A. The insertible saw-tooth A is made of cast steel or other hard metal, to

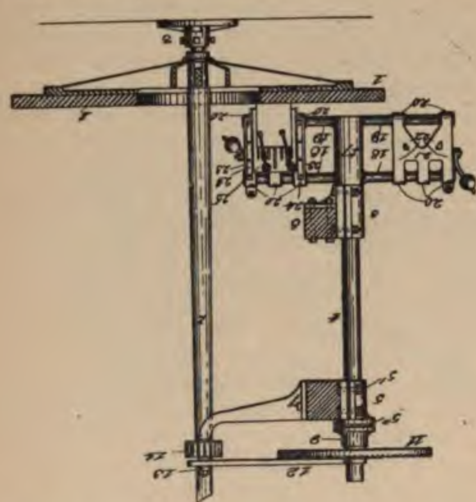
which a hard temper is imparted, said metal being cast in a mold around the diamonds so as to firmly hold the same in position. The strips *b b* are made of soft metal, such as brass, copper, soft iron, and the like, which are protected by the greater hardness of the tooth or bit B, which is made of greater thickness than the saw-blade and edge strips, and thereby prevented from being worn off during the sawing operation. The soft-metal edge pieces *b* are soldered on the sides of the tooth or bit B, so to adhere firmly. The hard metal from which the body of the tooth or bit is formed protects the saw-blade against abrasion and forms also a protection for the diamonds inserted into the same as the surface of the tooth or bit wears off slowly and evenly with the progress of the work. Owing to the soft-metal edge pieces the saw-tooth can be inserted readily into the recess of the blade without danger of splitting or otherwise injuring the tooth while it is riveted to the same.

No. 471,797, is a channeling machine, invented by Z. Lassor, of Stinesville, Ind. The invention is more especially directed to improvements in the clamping devices for rigidly securing together the cutters of a gang. These gangs of cutters operate by gravity—that is to say, they are raised by power and dropped by gravity to strike successive blows, whereby the channel is formed, and are, therefore, necessarily quite long, very heavy, and require correspondingly ponderous clamping plates for holding them together when in operation. The clamping-plate must not only hold the cutters, but guide them in their descent, and to this end are vertically channeled to receive fixed guide-plates or trackways directing their movement, and, besides, must be so constructed as to provide for their connection with the devices for raising the cutter-gangs in position to strike blows. As heretofore constructed these clamps have been made in two parts, one part of which may be said to be the fixed jaw or main body of the clamp, and having cast therein the guide-channels and projecting therefrom a lug for connecting it with the lever or other device for elevating the cutters. The other part of the clamp constitutes the movable jaw and is secured to the sliding but otherwise fixed jaw by bolts, which have usually been passed through the movable jaw and screwed into the fixed jaw, so as to firmly clamp the gangs of cutters lying between these two jaws. In the practical operation of these machines, notwithstanding the very strong and ponderous construction of these clamps, and owing to the sudden and violent jars they are subject to when the cutters are in operation, these bolts frequently break, and more frequently both the fixed jaw and the movable jaw are fractured and broken at their corners, where they are the weakest, because, as will be understood, the bolts must be at a point on either side of the cutters and on a line passing through the channeled portion of the fixed clamping-jaw. The object of the invention is to provide an improved clamp which shall be simple, durable, and effective, and in which the parts are so constructed and arranged as to be capable of being readily and conveniently put together or taken apart for repairs or renewal; and the invention consists in certain features of novelty in the construction, arrangement, and combination of parts hereinafter described with reference to the accompanying drawings, and more particularly pointed out in the claims. In the said drawings, Fig. 1 illustrates a perspective view of so much of a stone-channeling machine as embodies the invention; Fig. 2, an inner face view of the base or back plate of the fixed but sliding jaw of the clamp; Fig. 3, a traverse section on the line 3 3 of Fig. 1, with the actuating-lever shown in full lines; Fig. 4, a similar but enlarged detail view of the clamp with the cutters removed, and more particularly illustrating the bolts and position thereof for locking the movable jaw of the clamp to the fixed jaw for clamping the gang of cutters.



No. 474,033 is a machine for edging and surfacing marble tiles, patented May 3, 1892, by

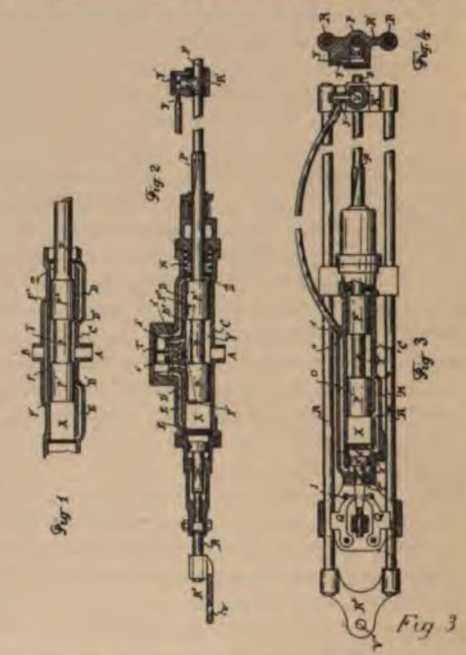
G. Taylor, of Atlanta, Ga. It relates to machinery and appliances for grinding by means of the ordinary circular metallic rubbing-bed blocks or slabs of marble, special attention being given to handling and holding the marble and feeding it onto and against the said rubbing-bed. The operation of the device is as follows: A slab of marble, usually termed a "tile," is placed against the sliding plate of the carriage at that time off of the rubbing-bed and clamped thereon by the clamps, after which the said plate is raised by lifting the weight on the pinion-shaft. The next carriage in rotation may then be filled in the same manner. As soon as a carriage is over the rubbing-bed the plate is lowered until the edge of



the tile rests on the same, the weight insuring a downward feed until the lever strikes the pin, when said carriage will descend by its own weight alone and a lighter pressure be given the feed until the screw carried on the arm in the plate contacts with the lug on the guide, which should take place before the revolution of the head shall have removed said carriage from over the rubbing-bed, which is provided for by the adjustment of the speed of the revolution of the head by moving the wrist-pin in its slot in the pinion, as specified. If another part of the rubbing-bed is desired to be used, or if a wider tile is to be edged, the carriages one and all may be adjusted radially to the head by sliding them along on the arms.

No. 464,069 is a rock drill, invented by Jean Sprenger, of Vevay, Switzerland, who assigned to the Aletiers de Constructions, of the same place. Following are the cuts and description:

In this invention the piston and piston-rod, to which is connected the rock-drill are reciprocated by the action of the air or steam under pressure, and the cylinder is supported upon



guide-rods, so that it may slide endwise, and there are clamps actuated by the fluid pressure to hold the cylinder to the guide-rods or to hold the piston rod to the cross-head, and the one is released as the other is brought into action, so that the cylinder and the rock-drill and the piston occupy the proper relative positions as the drilling progresses. In the cuts Fig. 1 is a longitudinal section illustrating the parts that may be made use of in giving motion to the piston and piston-rod. Fig. 2 is a similar section, longitudinally, representing the cylinder and a valve for controlling the action of the fluid under pressure. Fig. 3 is a sectional plan view showing the clamping devices, and Fig. 4 is a cross-section at the front cross-head. The steam, air, or other fluid under pressure is supplied by a pipe to the opening A into the cylinder C, and within this cylinder C are the pistons p' p^2, connected by the rod p, and the piston-rod P extends through a suitable stiffening box or head at the end of the cylinder and receives at its end the rock-drill. (Not shown in the cuts.) This piston-rod P slides freely through the cross-head R′ and there

LEGAL NEWS AND NOTES.

[Prepared for STONE, by V. H. Lockwood, Indianapolis.]

RECEIPTS.—A receipt is a written acknowledgment that a sum of money has been paid or something has been delivered, dated and signed by the person receiving the same.

A receipt is not *conclusive* but merely *prima facie* evidence of money having been paid, or something delivered. It can be contradicted by evidence, or proven false or wrong, wholly or in part, explained, or shown that it was given under mistake, or be corrected according to the facts of the case. It is unnecessary to insert "Errors Excepted" or "E. E." for the law excepts all errors in receipts.

There is no required form for a receipt. "Received this 6th day of May, 1889, $10.00 on account of (here describe the debt or contract)." "Received this 6th day of May, 1889, $40.00 of (name here) in full settlement of (here describe the debt)" are the usual forms.

When the payment is not in full settlement, the receipt should state that it is on account.

Where a check is given, a receipt is needless, for the check, if cashed, will show its receipt.

A party paying money or delivering anything else to another should always require a receipt at the time, showing the date, name of person paying, amount, and description of the debt, whether on account or in full settlement, and the signature of the person receiving the same. It should show every particular feature of the transaction, so as to prevent misunderstandings, mistakes, disputes and lawsuits thereafter. The friendlier and dearer the parties are to each other the greater is the value of the receipt, for it will avoid trouble. The habit of requiring such evidence of all persons and for all amounts, however small, will in a lifetime of business save considerable money and many friends, and prevent anxiety and quarrels innumerable. A man of the most ordinary sense and business prudence would in all cases demand a receipt.

BANK CHECKS.—A check (or cheque) is an order on a bank or banker for the payment of a certain sum of money on demand to a certain person named therein, or to him or his order, or to bearer.

It purports to be drawn on funds deposited in the bank. It is not final payment of a debt unless plainly so understood by the person receiving it, until it is accepted or certified by the bank. But after receiving the check and before it is presented for payment, suit cannot be brought against the drawer for the amount of the check, unless the bank is insolvent and presentment is known to be useless.

A check payable "to the order of bearer" or "to the order of bills payable" need not be indorsed.

Checks can be indorsed like bills of exchange and the rights and liability of holders and indorsers are the same as in case of bills.

The same rules of law in general apply to checks as to drafts and notes.

When a check is returned as paid, by the bank, it serves as a receipt.

When a Check Must be Presented for Payment.—It must be within a reasonable time, and if dishonored, notice must at once be given to all interested parties, unless these requirements are waived by the parties.

What a reasonable time is depends on the circumstances of each case.

If the bank is in the same place where the payer receives the check, it must be presented before the end of the next business day after receiving it.

If the bank is in another place, the check must be sent by the end of the next day after receiving it, and the person to whom it is sent has until the end of the next day to present it.

It must be presented during banking or business hours, and the bank has a reasonabe time, usually 24 hours, after presentment, in which to investigate the account of the drawer and to pay the check.

A check will not be paid by a bank after the death of the drawer.

Effect of Delay in Presentment and Notice. —As a general rule if the bank fails before the expiration of the time for presenting the check for payment, the drawer must sustain the loss; if it be after that time, the holder must bear the loss.

The drawer is not discharged by the failure to present the check for payment within reasonable time or to give him due notice of its dishonor, unless he has suffered some loss thereby, as by the failure of the bank—and then he is discharged only to the extent of his loss. The notice may be waived or the time for presentment extended by consent of drawer. Failure to present the check in due time will release an indorser.

An innocent holder of a check that has been out for several days, and for which he gave a valuable consideration, takes it free from all set-offs or defenses between the original parties. But if it continues unpaid for a considerable time the holder who takes it, does so at his peril, and all defenses can be put in against its collection.

A memorandum check is one on which the word "memorandum" or "mem" is written to indicate that the drawer waives timely presentment for payment and all notices of dishonor. So he cannot put in a failure to present the check within a reasonable time or to give him notice, as a defense against his paying the check to any *bona fide* holder.

Certified checks are checks accepted by the bank, by writing the word "certified" or some equivalent term on the check or verbally accepting the check.

This is an acknowledgment that the bank has funds of the drawer and will pay the check. Thereafter the bank becomes the principal debtor and the drawer, unless he had it certified and paid it out, is discharged, excepting in Illinois, where he remains liable.

A certified check does not bind a bank to pay a holder who has not received it in good faith. It does not promise to pay the payee named or the holder or to pay the amount named, where there has been fraud or a mistake known to the holder, unless he received it from an innocent holder for value.

A Forged Check. A bank must know the signatures of its depositors; it need not pay a forged check; but if it does it cannot charge the amount to the drawer. The drawer will be discharged, but the bank or payer can recover from the person who received payment on the forged check, the amount paid on it, as r paid by mistake or without consideratio the demand must be made for the money a reasonable time after discovering the fo

Altered or Raised Check. The bank not pay it, but if it does it is liable fo loss and cannot charge the depositor wi loss, unless he drew the check so carele to afford opportunity for alteration. E amount can be recovered from the per whom it was paid.

Any material alteration after the ch signed and filled out that affects the rig the parties makes the check void. Alter may consist of changes made in the amount, and in the number and relation indorser. They may be made by add erasing or substituting anything, but r filling a blank, where the signature is ge

The Dishonor of a Check by a bank w is apparently unobjectionable and the has sufficient funds deposited to pay i make the bank liable to the drawer for damages he may suffer therefrom.

Where there is a wrongful dishonor of a the holder cannot sue the bank, except seems, in Illinois, Iowa and South Carol

A Lost Check, if payable to bearer, m paid by the bank to the bearer, if the tures are all right. The loss will fall loser of the check. If notice of the l given, the bank must not pay it. When a is lost a bond with two sureties must be the drawer before a duplicate can b manded.

TRADEMARKS.—Any person has the ri affix to a product of his own manufactu symbol, mark, or device, not previously priated, that will distinguish it from arti the same general nature manufactured by others and thus to secure to himse benefit of increased sale by reason of a culiar excellence he may have given to it. mark thus becomes a sign to the public origin of the goods to which it is attach an assurance that they are the genuine of the original producer; and the cour protect him in the exclusive use of it.

What May and May Not be a Trade In general any tokens, letters, signs, ciphers, monograms, pictures or nume combination may be made a trademark.

Nothing, however, can be a trademar

does not identify the maker with the goods. The ordinary name by which an article is usually known cannot be made a trademark, nor can the name, sign or mark used to distinguish classes or kinds of goods; nor the name of a district of country applied to well known articles of commerce; nor a decorated tin pail or a box to contain the goods; nor the cut of a barrel or box of peculiar form without other and distinctive marks connected with it; nor a system of lines stamped on the article, nor the name of a town joined to the name of the article, although the name of the manufacturer and place of business be added.

The transfer of a trademark is effected by a sale of the business in which the mark has become established. It can also be transferred by special agreement, but the party to whom it has been transferred cannot affix it to goods much inferior to those with which it has been formerly identified so as to deceive the public in the quality of the goods and cause it injury. In such a case the courts will interfere and prevent its use.

A partner may continue to use a trademark belonging to the partnership after its dissolution, unless he has assigned his interest.

The Infringement of Trademarks. The courts will protect the proprietor of a trademark from the infringement or appropriation of it by others. It is a species of property that no one is permitted to use without the owner's consent.

Anything resembling the trademark that deceives the public in the purchase of the class of goods to which it has been appropriated by its owner is an infringement. But another person can use the same mark in connection with a different class of goods. And where the trademark consists of a combination of marks, letters, etc,, any other person can use a part of the combination to the same class of goods, if that would make a different mark, and not deceive the public.

A person has the right to use his own name in his business and to obtain the benefits therefrom, unless he so uses it as to appropriate the good will of a similar business already or previously established by others of the same name.

The owner of the trademark can have the infringer enjoined from further use of the mark and recover damages equivalent to the profits arising from the sale of the spurrious goods to which the trademark had been applied.

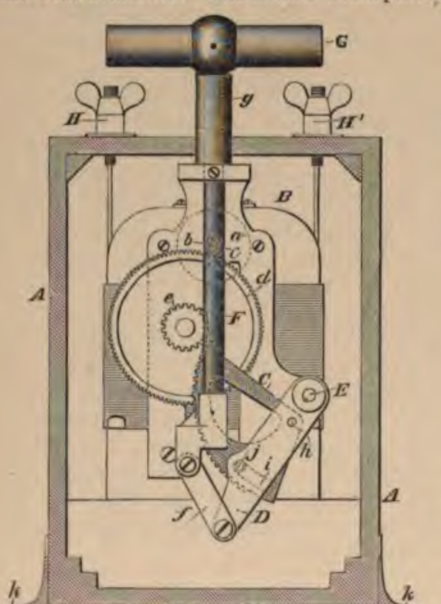
Damages From Idleness of Mill While Under Repair.—A very important case was recently decided in Michigan, The Hutchinson Manufacturing Co. vs. Pinch. The defendant, a mill owner who desired to have his mill machinery repaired, made a contract with the plaintiff by which they were to complete the work in ten days, during which time, of course, defendant expected to shut down. The work, however, was not completed for some days after the limitation of time understood by the parties, and the defendant refused to pay for the work. In the suit, defendant put in a claim in reduction of plaintiff's claim for damages due to the failure of the plaintiff to make the repairs within ten days. The question raised was, how should damages be estimated. It was held that defendant's damages were the value of the use of his mill while it was kept idle by the plaintiff's fault. When a contractor undertakes to perform a contract to put a mill or other machinery in operation, he should be holden to indemnify the other parties against the loss of the use of the mill or machinery after the expiration of the time for the performance of the contract. The prospective profits which might arise from the conduct of the business had plaintiff not been in fault cannot be taken as defendant's damages, because of their uncertainty. In lieu thereof, it is legal and proper to adopt an average sum represented by the rent which the property is worth. Hence, it might be said that the millowner's damage in such a case is the rental value of his mill during the time it is kept idle after the expiration of the period allowed for the repairs.

are guide-rods R R, extending from the cross-head R′ to the back cross head R^2, and this cross-head R^2 may be secured by a bolt passing through the hole V to any suitable supporting-frame or other device, and the cylinder C has near its ends projecting lugs or brackets through which the rods R R pass, so that this cylinder may slide endwise upon the rods R. Summing up, the invention consists of a cylinder in a rock-drill, of guide-rods upon which the cylinder may slide, cross-heads at the respective ends of such guide-rods, one of which is adapted to be held firmly in position, the piston-rod sliding through the other cross-head, a clamp applied to the piston-rod, clamps adapted to act against the guide rods for holding the cylinder in position, a piston and wedge-shaped piston-rod acting upon the clamps, ports, and a flexible pipe extending to the front cross-head, whereby the piston-rod and cylinder are clamped and released alternately.

PUBLISHER'S ANNOUNCEMENTS.

THE MACBETH IMPROVED ELECTRIC BLASTING MACHINE.

JAMES MACBETH & COMPANY, located at 128 Maiden Lane, New York, manufacturers of electric blasting appliances, have recently patented the improved electric blasting machine shown in the accompanying illustration. The mechine is novel in its construction, especially that part of the machanism which actuates the armature. The handle when pulled



upward moves the arm D, this arm imparts its motion to the geared segment C, which in turn engages with the small pinion *e*, transferring the motion to the armature shaft *b*. When the handle has reached its full height, the segment C, with E as a center, has performed its duty as a segment of a circle with E as a center; at this point the center of the segment takes the pin *h*, as a center, and is eccentric to its former position. The teeth then disengage from the pinion *e*. The handle when released allows the segment to return to the position shown in the illustration. The machine is arranged with foot rests *k k*, to hold the machine down when the handle is pulled upward. H H, are the points of contact. It is claimed that the machine is not likely to be overthrown and is more efficient in its work than either the ratchet or lever machines. It is made in three sizes and designed to fire any make of electric fuses also to meet the requirements of those who desire to fire a large number of blasts at one time. No. 3 will fire twenty to thirty holes; No. 4, forty to fifty, and No. 5, seventy-five to one hundred holes.

AN IMPROVEMENT FOR DERRICKS.

Mr. A. Myers, president of the Credit Valley Quarries Co., 263 Sherburne street, Toronto, Ont., thus describes a device of his invention of a turning or swinging gear that may be applied to any properly constructed derrick: "I have read the description in your June number of the large derrick built by the Messrs. Milliken Brothers, of New York, for C. E. Tayntor & Co. Granite Quarry, and mention is made about applying a turning or swinging gear to the mast. I had a patent issued to me, called the A. Myers Derrick, for the United States, on May 3, No. 474,142, for the swinging gear. It is cheap and in reach of every quarryman. I put it on my derricks last fall. I have it on my three mast 70 feet high with 65 feet booms. I have three 24 horse-

power hoisting engines of the Lidgerwood type. The small friction drums that work the swinging gear are geared into the hoisting drum of the engines and are worked by the engineer by an upright lever that runs under the frame of the engine and stands on front of the main fall hoisting lever. He has perfect control of the swinging gear; he can hoist the stone or weight of any kind; lower or hoist the boom and swing the boom all at the same time; can make a complete circle. The mast, of course, is guyed with wire cables. I am working them in our quarries so that any one can see their practicability and how easily the swinging is done of a stone, no matter what weight. Will send you a cut of same. Have any quantity of letters from patent agents from your place, the O. D. Patent Agency, Traders Patent Exchange; in fact, I was tired of getting letters from those fellows. I am getting a model made, then I will be ready to do business myself with some firm for the manufacture of them. I have patent for Canada.

BREAKING PREVIOUS RECORDS.

Business generally is considered quiet and many complaints are made by machinery men. However, as a notable exception to this, we find that the Lidgerwood Manufacturing Company, of New York, makers of hoisting engines and cableways, have broken all previous sales records during the month of May just passed, having shipped 127 engines and 45 boilers, an average of five engines per day. This speaks volumes for the character of the hoisting machinery as manufactured by this well-known company.

THE TRUE BLUE MARBLE COMPANY'S NEW MILL.

The old mill of the True Blue Marble Co., at Rutland, Vt., burned January 30, last. A new mill was promptly contracted for with the Berlin Iron Bridge Co., and erected and running in 60 days. The building is made of steel with corrugated iron roof and sides down to within eight feet above foundations; masonry of blue marble from foundation up eight feet, and is absolutely fire proof. The building is 254 feet long by 80 feet wide, and there are 16 extra wide gangs that take in two blocks each; the finishing shop is in the same building. In all respects it is an exceptionally fine mill, and testifies to the energy and business success of the company who owns it

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A REMARKABLE RECORD.

POTTSVILLE, PA., July 1, 1892.

At York Farm Tunnel near Pottsville, on the Lehigh Valley Railroad, we drove in the month of June last in a single heading 333 feet of tunnel finished complete, including ditch as measured by the engineer this morning. We used Ingersoll-Sergeant drills exclusively, miners' safety lamps, and we did no Sunday work. (Signed,) JOSEPH DOLAN, Contractor.

The foregoing is a clean and remarkable record, as it occurs in hard rock, and in a general course of work, that is, the drive was not a special one for which any special preparation had been made.

The Bowen-Merrill Co., of this city, have made a new and elegant edition of James Whitcomb Riley's book of "The Old Swimmin' Hole" and "Leven More Pomes," generally entitled "Neighborly Poems." It will be needless to say anything in their praise, for everybody has read the homely farm life his pen has made to blossom in the hearts of all from the time the cowslips blossom till the "frost is on the punkin an' the fodder's in the shock." Of all American poets he is decidedly the most original, and none since Burns has equaled him for depth of philosophy or keenness of humor. The volume is elegantly printed and embellished with fine half tone pictures of his various ideals. The price, in cloth, is $1.25.

The pencils of the Dixon Crucible Co., of Jersey City, N. J., are the favorites of the press people, whereof we speak from everyday experience. This company manufactures every sort of device or material that can be made out of graphite.

FOR SALE, WANTED, ETC.

WANTED—A first-class foreman to take charge of stone-yard, working from 30 to 40 sandstone cutters. Must be practical, energetic and experienced with plans and soft stone. Permanent situation guaranteed to the right man. Address P. S. C., care STONE.

WANTED—Position as solicitor or draughtsman for quarryman or manufacturer of architectural and monumental stock. Can estimate on and take charge of construction of bridge and other substructures. Address "ENGINEER," care box 285, Crown Point, Ind.

WANTED—Communication from a sandstone quarryman of experience to go to California and take contract for quarrying building stone by the cubic foot. Work the year round. Derricks and tools furnished. Fine climate. Give reference. Address WM. FARWELL, Niles, Alameda county, Cal.

WANTED, SITUATION.—A young man who is strictly sober and industrious, a first-class stonecutter, a good draughtsman, and has a thorough knowledge of plans, is desirous of obtaining a position as foreman on building work. Southern location preferred. Address, FOREMAN, P. O. Box 312, Chattanooga, Tenn.

FOR SALE—Being engaged in stone quarrying and contracting, I would sell my marble business here. It is the oldest monumental shop in Oregon. Albany is a city of 5,000, county seat of one of the best counties in the state. This is a first-rate opportunity for a practical man with some means. Prices are good for good work. Address FRANK WOOD, Albany, Oregon.

PARTNERSHIP—A thoroughly practical stonecutter and quarryman with twenty years' experience in business, thoroughly understands all plans, details, etc., capable of making estimates on all kinds of stone work as also all general contract work, railroad masonry, etc., with a small amount of capital wants an interest with a good firm doing business. References exchanged; please correspond. Address OLIVER HURST, Fort Hunter, N. Y.

WASHINGTON, D. C. Office—Builders' Exchange
BALTIMORE, MD. Office—301 N. Charles-st.
PHILADELPHIA.
RICHMOND. NORFOLK.

WM. C. LEWIS,

Stone Broker

—AND—

General Agent.

Bluestone, Indiana Limestone, Ohio Sandstone, Brownstone, Marble, Granite. Correspondence solicited.

WANTED—A man that can polish marble and cut bases; write stating wages. SALES & SEELEY, Lewiston, Mo.

FOR SALE—One-third interest in a good pink, Tenn., marble quarry in operation. Three miles from Knoxville. Address "MARBLE," Knoxville, Tenn., care Dr. B. D. Bosworth, Church street.

Williamsport Stone Company,

John Gregory, Prest. B. R. Gregory, Sec'y and Treas.

Capital $50,000.

We quarry all sizes and kinds of stone and make satisfactory contracts. Mill blocks and all other description. This stone is all quarried by the steam channeler process. Contracts solicited and orders filled promptly. Address B. R. GREGORY, Sec'y & Treas., Williamsport, Ind.

DAVID REED,

Quarry Owner and Wholesale Dealer in

Buff and Blue

BEDFORD STONE,

ROOM 909 CHAMBER OF COMMERCE,

CHICAGO, ILL.

Quarries and Mill, Bedford, Ind.

Hawley's Patent Sand Feed

Is used by all the leading firms—saws faster and better than any other sand-feed. More gangs using our feed than any other. Easily kept in order. Over 50 gangs working satisfactorily, using either crushed steel or shot with our feed. Can give best of references.

Orders solicited.

E. J. & C. H. HAWLEY, MANCHESTER, VT.

J. HOADLEY & SON, STINESVILLE, IND.,

Wholesale Manufacturers and Dealers in all Kinds of

Turned Indiana Oolitic Limestone,

TURNED COLUMNS, CAPS, BASES, BALUSTERS, FINALS FOR BUILDINGS.
Posts, Vases, Founts, Everything in the Turning Line Neatly Executed. Cut-Stone Fronts, Cemetery Vaults, All Kinds of Stone Trimmings, etc.

SLATE

R. HANGER'S SLATE WORKS

HYDEVILLE, VERMONT.

Celebrated Vermont Building Slate,

STEPS, PLATFORMS, URINALS, TUBS,

Cemetery Work, Vaults, Catacombs,

BILLIARDS, MANTEL STOCK. ESTIMATES GIVEN QUICKLY.

B—*Stone.*

FAMILY VAULT OF F. APPEL IN PERE LA CHAISE, PARIS.

STONE

VOLUME V. AUGUST, 1892. NUMBER III.

THE ROAD PROBLEM.

PROF. LOUIS M. HAUPT, CONSULTING ENGINEER.

THIRD RUMINATION.—ON THE WAGON.

"HE THAT HATH EARS TO HEAR, LET HIM HEAR."

HORSES, and mules, too, are gregarious. We all love company, and hence I am always glad to find the double harness put on, for it is easier to work when you have a mate to carry half the load, and as I don't want to be considered lazy, I do my part without urging. Then, too, I have more room when hitched to a tongue, and can pull more freely than when in the heavy shafts with a large part of the load dragging on my back and pressing me into the mud. But above all things, I despise a cart with its driver sitting on the shafts and making me trot home at the end of a hard day's work. Mike was very considerate and whenever I had such a load as this which you see in the picture to haul through such deep ruts, with wheels clogged with frozen mud, he always walked and let me stop when I pleased to blow. The spring-wagon, in which the shock of the load is eased up and carried to the earth instead of to my back, is a great relief to the road as well as to my anatomy, and I often sigh for the prairie-wagon made by Mr. ——, because he knew what was needed in a wagon. It was more like a road roller, and passed so lightly that it hardly left a track on the turf. The wheels were large and the tires broad, the axles were of unequal length, also, so that they covered two feet in width of roadway, and

had a bearing on an ordinary earthy soil of 72 square inches, or half a square foot. Now, there are not many soils that will stand more than three to four tons per square foot without yielding, even when dry and below frost line, so that with a two-ton load, including the wagon, even these wheels would sometimes cut in, and we had to drag the load up hill, but it was nothing like so bad as with the two-inch tires. On these wagons the pressure was equal to twelve tons per square foot, and the rutting of the road was more than three times as great, while the load was much harder on us, and we had to follow the ruts. Beside all this there were eight deep grooves in the road, so we could not get a foothold, but were obliged to stumble along between rut and ridge as best we might. Finally, in trying to turn out to pass a coal team our rear axle snapped short off at the hub, and we had to be unhitched and taken home for the night. It took all the next day to get the wagon to the shop and the load to the barn. I am told that in France the tires are from three to ten inches wide, usually from four to six, and so rolls the road smooth. On many of the four-wheeled vehicles the tires are six inches wide, and the rear axle is about fourteen inches longer than the fore, so that the wheels cannot track. The different length of axle is also applied to cabs, hacks and other four-wheeled vehicles, which is an excellent wrinkle for our wagon-makers to note, as it will not add anything to the cost of the wagon, and will soon make the fortune of the man who introduces it. The cost of hauling in France does not exceed one-third that of the United States, which will explain in part why that country can pay her heavy debts off so rapidly and recover from reverses. These are but a few suggestions for thought for the benefit of my masters.

Your servant, MR. MULE.

THE DOUBLE FUNCTION OF MONEY.

DIFFERENCES of opinion on the financial policy that should be adopted by the government are as various as the occupations of people that throw the question under differing lights of experience. It cannot be said that the discussion has advanced the solution of the question in any way, and the advocates of a sound basis as gold, seemingly content themselves with that phase of the question, while the silver party and the various cults agitating for the fiat principle not only fail to make clear the salient feature that pertains to a paper currency, but have obscured it the more with conditions that are self-destructive to any credit basis whatever, which is all that a paper currency can ever be made to represent, and is all that that portion of a legal silver dollar defined by the differential between the actual value of gold and silver, can be made to represent. The farmers' clubs in their demand that government should operate storage houses for produce and advance money upon them, contains a germ that if nourished would result in great improvement, but the germ, in the practical sense, was destroyed by a demand that government should set a given value upon the product, and advance 80 per cent. of that assured to the holder. The most that government could do would be to store the product and indorse its receipt to the holder, and this receipt, through the perfect moral reliability and solvency of the indorser, might act as money in many of the transfers of commerce, without usurping any of the functions of money.

The obscuration of the fact above referred to, whether by single gold currency advocates, or fiat money agitators, has followed because neither side have perceived that money exercises two functions, one as the standard of value, and the other as a medium for exchange. A wheat or port receipt might answer as a medium for exchange, but it is clear could never act as a value standard, owing to its rapid fluctuation. As money they could be made to exercise this function in a far greater ratio than they now do, and as this use extended, by its amount would that money, as gold, representing an intrinsic value standard, be retired.

A writer in the London *Financial Times* discusses this factor of trade exercised by commodities in their paper representative, and the analysis, showing as it does, that the process has even now largely usurped the func-

tions of coins, only shows that the clamor indulged by both monometallists and fiatists is unreasonable and badly conceived. The writer says:

"Let us look at the actual conditions under which international trade is carried on at the present day. These, rather than the teachings of economic text-books, written when there were no telegraphs, no Suez Canal, no deluge of silver and no fifteen-penny rupee, may furnish us with a clew to the multiplying mazes of foreign exchange. One of the first of them to arrest attention is the fact that international commerce has outgrown a purely metallic basis. So far as that is concerned gold and silver are every year doing more of their work by proxy. While theorists discuss their functions and their special qualities as money, a silent revolution is going on which may end in changing the whole situation. In economizing the use of the precious metals, bankers and money dealers do not profess to be actuated by philosophic motives. They simply adopt what they consider to be improvements in business, and it is not for them to concern themselves about how such improvements may react on currency theories. They may be cutting away the foundation from some of our most cherished economic doctrines, but all the excuse they would offer is that the world cannot stand still.

"The movement of the precious metals by proxy has not been more revolutionary in foreign trade than it is in the science of money. In some important respects it entirely changes the functions of gold and silver in our time from what it was fifty, or even twenty years ago. It renders the banker of to-day almost independent of considerations which used to be of primary consequence with him. Formerly he had to reckon on a considerable amount of actual handling and transport of precious metals, therefore their superior transportability had a real value for him. Nowadays physical movements of the metals is the exception rather than the rule, and their superior transportability is thought of only as an abstract virtue. Gold and silver have been taught the art of traveling figuratively, and many of their commercial journeys are now performed either through the post or by telegraph. They have become, in fact, paper money, guaranteed by coin or bullion held against them in some safe keeping. But if gold and silver may with advantage be converted into guaranteed paper, why not other metals—why not any other commodity which can as conveniently be deposited in large quantities in safe keeping?

"A very broad and far-reaching principle underlies that inquiry. In its ultimate form it comes to this: Cannot commodities, or, at least, staple articles of trade, be made to circulate themselves; in other words, to furnish a basis for their own currency? The suggestion is more novel in theory than in practice. Some important trades are already so organized as to be to a certain extent self-circulating. Thousands of tons of pig-iron are represented on the market by warrants which within a given area, have

all the value of a circulating medium. In the United States, crude petroleum is known chiefly to commerce in the form of 'certificates,' which pass from hand to hand with the same facility as a bank note. The London Metal Exchange has also its warrants of various kinds which, though current only on à small scale, also helps to illustrate the principle of self-circulation. In a rude and fragmentary way these warrants, certificates, or whatever they may be called, serve the purpose of a paper currency on a metallic basis. In scientific character they are analogous to the Scottish pound, secured on a specific deposit of gold. In one respect their security is better than that of the note, for the guarantee or pledge is not, as in the case of the Scottish banks, held by the issuer, but by an independent third party.

"If the personal convenience of the users had alone to be considered paper 'would be your only wear' in currency. But there is a further question of security which shall be at once safe, readily negotiable, and free from violent fluctuations. The ideal pound note has got to be well fortified in these respects, but any metal or commodity which fulfils the same conditions may be, modern finance, as good a currency basis as gold and silver. The advantages which the latter possess over all other commodities of easy transport being no longer indispensable, they have to fall back upon their less distinctive qualities. It is chiefly as a backing for paper that gold and silver are now thought of in relation to money. All authorities, monometallists and bimetallists, are agreed that their actual physical use should be as much as possible minimized. A well-known banker in Scotland strongly supported Mr. Goschen's one-pound note scheme as a measure of monetary economy. He pictured the great advantage it would be to recover thirty million sovereigns or so from the crowd and lock them up as an addition to the national gold reserve. But he contented himself with a very small application of a very large principle. If we are to have a circulating medium which does not circulate, but only sets something else in circulation, why not avail ourselves of many other things than gold and silver?

"Once adopt the principle of a guaranteed currency, how can you draw nice distinctions between one metal and another, or between one commodity and another, as an admissible form of guarantee? You cannot ground your distinction on transportability, for that is a secondary consideration. Steadiness of value perhaps? Even that will be difficult to maintain. According to the newest economic teaching gold and silver have lost their traditional character for steadiness of value, and are subject to fluctuations the same as iron or copper, only in a different way. Their steadiness, we fear, was always more or less of a metaphysical idea, for its advocates could never say precisely how it worked. Even with all the privileges which statute and convention conferred on them, the precious metals have never

been free from fluctuation. At this moment they are both shining examples of the opposite of what they profess to be. One set of currency men attribute low prices and bad markets to scarcity of gold. while others are as positive that it is due to a plethora of silver. Whichever may be right, both are doing their best to prove the unsteadiness of the precious metals as a standard of value.

"What other monetary quality have they then, to tell in their favor and against all other commodities? Simply their small bulk. The so-called precious metals of to-day have but one absolute and unassailable advantage over other metals and that is their compression of value. They can be more easily stored than any other known commodity save diamonds, and in a system of currency, involving storage of securities, that is still a great merit, though not the greatest. It differentiates the precious metals not in kind but in degree. It excludes no other commodity from the privilege of assisting as a basis of currency if it should otherwise answer the requisite conditions. In a scientific system of circulation by proxy we thus get rid of theoretical tests and distinctions, and are able to concentrate attention on one or two practical questions. Instead of attempting to maintain an imaginary steadiness of value in the thing itself, we can ask for a basis with adequate margin to cover all ordinary risks. A gold warrant, or a certificate of government bonds, if it has a cover of 20 or 30 per cent. above the amount it was issued for, will have more real steadiness than any one of the commodities on which it may be secured. Such a circulating medium would also have the merit of not pretending to be more than it really is. It would be simply a symbol—a form of translating values from one commodity into another. It would not profess to be at the same time a standard of value like that mystic talisman, the gold sovereign.

"In the eyes of a true currency devotee, the sovereign has a poetic ideal character far transcending its material form. It is said to be the final measure of value—the loadstone by which every other commodity has to be set and regulated. But the ideal sovereign, or rather the ideal pound, is a creature of scientific imagination. There is nothing real about it, save its being a convenient middle term for comparing the price of one commodity with the price of another. One day it stands for so many pounds of beef, or so many yards of cloth, or so many hours' labor of a man. Another day it may stand for a less quantity of beef, a greater quantity of cloth and the same quantity of labor. The real change, however, is not in the ideal pound, or so-called standard of value; it is in the relative values and interchangeability of the articles themselves. The ideal pound is a common denominator to them, but nothing more. Its sole virtue is its protean facility of comparison. It may be at one and the same moment the equivalent and interpreting symbol of a hundred different commodities. Its ex-

istence does not depend on the gold sovereign, or on any form of coin or currency. It is an essential and inherent mode of thought applied to values in exchange. The pound, as a unit of value, might remain the same, whether represented by gold sovereigns, gold certificates or iron warrants. It supplies the form of value, while the commodity against which the certificates may be issued supplies the substance. The two together, clearly understood and adequately safeguarded, would be a self-acting currency which might be made to circulate freely through the whole commercial world.

NOVEL METHOD FOR EXTINGUISHING FIRES.

AN original method has lately been proposed by a New Hampshire inventor for the extinguishment of fires. To accomplish this purpose a chemical generator as large as may be needed for the case in hand is first provided, and pipes run from this into each room in the building; at the top is a jar in which acid is stored, inside of which is a cartridge; an open circuit battery is used. The thermostat in each room is set at whatever figure is desired, perhaps at 80 degrees. On the occurrence of fire, the mercury runs up to this figure, and the circuit is closed; this explodes the cartridge in the jar, a valve drops down, and the chemicals are sent to the room through a system of sprinklers. In connection with this device there is a system of dry pipes, and in case it is found that the chemicals do not extinguish the fire, an attendant on the outside of the building is able to tell by the enumerator in which apartment the fire is located, and by turning a switch can flood the room with water.

PLEASES THE ADVERTISER.

"Allow us to compliment you on the excellent appearance of the first issue of your paper under the new magazine form. It is, in our judgment, a vast improvement over the old and cumbersome style. Unless we are mistaken, a large number of the trade journals will follow your example, and put the papers into more convenient shape for their readers.—*American Hoist & Derrick Co.*"

NOTES ON QUARRYING.

ROCK BLASTING BY ELECTRICITY.

IT is obvious that in all other blasting machines the strength of the current must depend largely upon the personal equation of the operator. This is shown by the testing lamp, which, by the-way, is a good device to have around every blasting operation. The testing lamp is nothing more than a common incandescent electric light lamp, except that it is made with a small wire connection instead of the horseshoe-shaped one common in light lamps. It rests on a small cast-iron stand and can be procured at an expense of only $2.25 from manufacturers of blasting outfits. These lamps have short pieces of wire by means of which they are connected with the poles of the battery. The battery is used in the regular way as when blasting and the full strength of the current is thrown into the lamp lighting it up. With all machines except the "Crescent" the light varies in intensity with almost every operation. Sometimes it is a dull red, then again a bright white, according to the speed of the armature at the time the circuit was changed, which, of course, depends upon the skill of the operator. With the "Crescent" battery the operator simply turns a shaft on which there is a rack and in turning it is resisted by a spiral spring. If he has force enough to press this spring to the tripping point he may be certain that the battery will discharge exactly the same strength of current at each operation, and no matter who may operate it. No skill whatever is required.

On the shaft of the "Crescent" battery there is a ratchet nut which when tightened gives the spring more tension, hence by adjusting this nut, not only may the capacity of the battery be kept up, but it may be set at any number of holes. The testing lamp shows a light from this battery of exactly the same intensity at each operation.

The rounded top of the "Crescent" battery is an advantage in that there is no chance for moisture or drops of water to damage the machine. Where the handle is on top water will sometimes work itself down into the parts and destroy them. The top of the "Crescent is made of indurated fiber, which is not only light, but being a non-conductor of electricity there is no chance for the current to be thrown into the operator, or lost in the ground. In all other batteries except the "Crescent" the operation is a violent one,

but in this case it is just the contrary, the directions given being to move the handle slowly. After the blast has been fired the handle is taken from the shaft and put away so that the battery may be left in the mine without the liability of its being tampered with or damaged.

Uniform strength or quantity of current at each operation is an important one in electric blasting. In the first place it is important, as previously pointed out, to have a surplus of force in your battery. A common cause of misfires where several holes are in circuit is a weak battery—or what is just the same thing—a weak discharge from a strong battery. A weak discharge will not produce sufficient redness in the exploder wires to make the blast, and as one exploder may differ in its resistance from another,

FIG 4.

a weak current sometimes discharges one or two holes while the others do not go off, not because of any break in the connections, but simply owing to the fact that the little platinum bridge embedded in the fulminate of mercury did not get hot enough. It is a curious fact that with several exploders connected in series a week discharge will usually set off those nearest the poles of the battery. In other words, if we have, say 10 exploders all connected together, and through leading wires connected with a battery, and our battery is not strong enongh to discharge them all, those which go off will be the ones nearest the leading wires, while those in the middle or at the loop can be discharged afterwards by changing the connections. If any one of them is afterwards discharged it proves that the connections are all right, and that there is no exploder in the line that

can be called defective. The fact that those which did not go off in the first operation may be set off when tried with a less number in the circuit, is an evidence of the weakness of the battery, and it is needless to point out the danger and expense which might arise from such a state of things as this. I have experienced it frequently when attempting to blast a large number of holes. Figure 4, illustrates the whole operation of electric blasting showing 4 holes connected in series with the battery in the distance.

Tamping bags made of paper are useful in blasting operations. These bags are furnished of varying sizes, corresponding with the diameter of the hole, are usually from 12 to 30 inches in length, and cost about $5.00 per thousand. The importance of tamping should not be overlooked. It is quite too common a thing for the foreman to use the handiest soil he finds for tamping holes, while much might be gained by the use of tamping bags filled at the proper time with the best tamping material. Dry sand is as good as anything, except, perhaps, pebbles, and the worst thing of all is wet clay, though how common it is for wet clay or loam to be simply jammed into the hole with a stick!

The best tamping for a drill hole is that which is not like a cork, something to be blown out with a "pop," but, on the contrary, it must be of strong resisting character, something which changes form when disturbed, and which will tend to wedge. There are a great many patented plugs for tamping holes, but in no case can a plug, even with a wedging tendency, be strong enough to resist the force of the explosion. A wedging plug, such as inverted plugs and feathers in the mouth of the hole, is too expensive and involves too much delay in its application, besides there can scarcely be as much resistance offered by a solid plug of any kind as there is in a large quantity of small disintegrated particles which not only tend to wedge among themselves, but the disturbance of which creates friction through the mass.

In Europe dry clay is used with success, while in coal mines soft shale is used because of its accessibility. Broken brick moistened, and the dust from the drill hole are frequently employed, and it is well to bear in mind that if things which are near at hand will serve the purpose they had better be used. This point can be determined by the quarry foreman, who should be sufficiently interested in the economy of the work to see that holes when blasted do not throw a large part of their force into the air. I have stood within 500 feet of a blast and have had broken pieces of stone almost as big as my head thrown around me, some of them having been sent up into the air 1,000 feet. Such reckless work is criminal besides being expensive. The force generated by a blast should be confined within the hole, and there is no better evidence of the fact that it can be so confined than the work

done in the upper part of New York City, where large blasts are made directly in contact with the walls and foundations of buildings without damage beyond an occasional tumble of plaster caused by the jar. The law has taken the contractor in hand in New York City to such an extent that he has been compelled to tamp his holes carefully and the result is that almost a perfect system of blasting is now in force among the better contractors and not a single piece of rock is thrown during a blast.

Quarrymen will do well to look carefully to this question of tamping as good tamping saves the powder, is a means of safety and prevents destruction and waste of stone. When I began to blast rock under water I was told that water was a good tamping and every blast should be made at high tide. I have learned by experience that the reverse is true. Water is the worst kind of tamping, except in surface blasting where it is directly over the charge or in drill holes where the rock is perfectly sound and free from fissures so that the water pressure is only on top of the cartridge and not around it. It is obvious that a cartridge in a drill hole under water unless it is plastic and fills the hole completely is acted upon by the water pressure from all sides, hence the first thing which the force of explosion has to do is to overcome the hydrostatic pressure and in doing this it loses a large amount of power before it strikes the walls of the hole. One-quarter of a pound of dynamite will do as much execution in dry blasting as one pound in submarine work.

When a drill hole is ready for tamping it is best to use grass or a handful of rubbish of some kind first, so as to form something of a cushion at the top of the cartridge. This wad should be pressed directly on the cartridge, no air space should be left, except in dimension stone blasting where the Knox or other process is used. The harder the rock and the more thoroughly it is desired to shatter it, the tighter should be the tamping and the more closely should it press upon the cartridge. A rod of wood is best and safest for driving the tamping. At first the rod should be simply pressed tightly in the hole, but near the end it may be used with a hammer movement. In all cases be careful not to rupture the wires which lead from the hole. These wires should be held taut in one hand while tamping so that there may be no tendency to kink. A projecting piece of broken rock in tamping is likely to cut the wires, though a careful operator may mix broken stone with sand and other material and make an excellent tamping without cutting the wires.

Wm. L. Saunders.

COST AND SELLING PRICE OF STEEL RAILS.

THE stereotyped argument of the apologists for combinations, trusts consolidations, etc., is that "they enable their participants to intro-, duce various economies in their business by which they are enabled to reduce cost and selling prices and thereby benefit the general public." With this argument in view we should expect that the several cosolidations of steel rail mills that have taken place within the last few years, by which practically all the steel rails made in the United States are made by six large companies, would have tended to bring down the price of rails.

It is the boast of the engineering departments of our steel works that they have recently made marvelous strides in perfecting their machinery, so as greatly to increase the capacity of the mills and to reduce the labor cost. This might be expected to bring down the price of rails, as should also the reduction of nearly $4.50 per ton in the price of Bessemer pig iron during the past two years.

The old political economist used to teach that prices are governed by the law of supply and demand. If this law governs the price of rails, they should be at a lower price than they have |been for many years, for the ratio of the demand to the supply, or to the capacity for supply, of the mills was never lower. Finally, if sympathy with the general market has, as many writers claim, an influence on prices, then steel rails should go down in price from that cause, for in the general iron market prices are the lowest ever known.

Not one nor all of these causes combined seem to have any influence upon steel rails. They are a law unto themselves, and neither Baring Brothers' failure, the McKinley bill, the election of 1890, the subsidence of the Southern boom, the vast crops of 1891 or the floods of 1892 have any effect upon them. They not only violate all the laws of political economy, but they are superior to all convulsions of nature or of finance. Unlike other iron products, they do not give a market reporter a chance for the use of his imagination or of his gift of prophecy. For eighteen long months, or ever since December, 1890, he has had to write the same old story, "Steel rails are firm at $30 at mill, but the demand is insignificant."

One of the most remarkable things about steel rails is that no one financially interested in them as a consumer seems to complain about their price, and that there is no concerted effort anywhere to reduce their price. No attack has ever been made in Congress on the rate of duty upon them. Half a dozen railroad magnates by agreement among themselves to postpone purchases of all rails not absolutely needed for one year, or until the price was made $25 per ton, could bring the price to

figure within a month, if they would agree to give long contracts at that price. But no such effort is made, the price remains serenely at $30, and the railroads pay it without murmuring.

A comparison of the prices of steel rails at mills in Pennsylvania, and of Bessemer pig iron at Pittsburgh during and prior to the time when steel rails began to violate the laws of trade, may prove of interest. Here are the figures for the four years from 1888 to 1891, inclusive, taken from Mr. Swank's annual reports :

	1888.	1889.	1890.	1891.	June, 1892.
Steel rails	$29¾	$29¼	$31¾	$30	$30
Bessemer pig	17⅔	18	18¾	16	14
Difference	$11⅛	$11¼	$13	$14	$16

Rails were quoted $27 at Pittsburgh in May, 1889, and were sold as low as $26 at the mill.—*Engineering and Mining Journal.*

OVERWORKED MICROBE.

THE germ theory is in danger of being overworked. Nearly every disease has been credited to bacilli, and at last human habits and feelings have been analyzed in the same way. John Smith tells the Buffalo *Express* that now a Philadelphia scientist has discovered, or says he is just going to discover, that the liquor and tobacco habits are caused by microbes, like consumption, catarrh and grip. He also thinks there is a microbe of love, and that the reason a young man's fancy turns to thoughts of love in the Spring is because the atmospheric influences of late Srping and early Summer are favorable to the existence of the microbe. The man who habitually wants to borrow money is, according to this scientist, also effected with a microbe. In short it would appear that not only all diseases, but all habits, emotions, feelings, etc., are taken into the system with the air we breathe. The only safe way is not to breathe.

"LIFE MEMBERS."

"Herewith please find postoffice order for $2.00, to be applied to the renewal of our subscription to STONE for another year. We never fail to find something valuable in connection with our business in each number. Typographically it is exceptionally good, while the new form is the acme of convenience. You may consider us as 'life members' of your constituency.—*Inyo Marble Co., San Francisco, Cal.*"

THE MARBLE ANGEL.

A RING of hammers; a sound of rifting;
A strain of chains; the block uprose;
Light on its crystals glimmering, shifting,
Reflected color shakes and glows.

An artist near his chisel holdeth,
We see no beauty in th' rugged stone—
But an angel's form the block enfoldeth
Which none can see but he alone.

Oh, genius, thought, that power eternal
Which can release from repulsive rock
Airy forms or forms infernal,
And find the angel in the block.

In every stone an angel hideth,
Had we the power to see and know;
In every life a love abideth
Which with encouragement would grow.

Burton H. Allbee.

THE BUILDING-STONE INDUSTRY OF THE UNITED STATES—II.

PASSING from the marbles to limestones of the common type (and the term limestone is here used to designate a stone composed essentially of carbonate of lime, and not merely one of which lime is made, as defined by the authorities of the eleventh census) we have space to note but briefly a few of the more prominent types. While the process of folding and incident metamorphism threw out of place, and in many cases shattered and faulted as well as crystallized those beds of calcareous materials lying along and adjacent to the mountainous regions, converting them into marbles, or at least so indurating them as to render them plucky and difficult to work, those lying in the interior, the great plains regions, were left undisturbed, or subjected only to the changes caused by percolating water and the weight of the overlying materials. Hence it is that within the areas drained by the Mississippi and its tributaries, we find the best and most extensive developments of what are popularly known merely as limestones. Some of these are to the least educated eye mere masses of indurated mud full of fossil shells or shell impressions, while others are fine, compact and homogeneous, lying in even, nearly horizontal beds, free from flaws and bad joints, and in every particular calculated to afford supreme delight to the quarrier's heart.

FIG. 1.

Beyond doubt the most important of structural materials which are grouped under this general name are the so-called oolites, or oolitic limestones, from the subcarboniferous formations in Southwestern Indiana and adjacent portions of Kentucky. The applicability of the name oolite as applied to the stone becomes apparent when we consult the accompanying figure, which shows the structure as it appears when in thin slices it is ex-

amined under a magnifying power of some twenty-five diameters. Its entire mass, with the exception of the small amount of interstitial matter, is made up of small concretionary grains of lime, resembling nothing more than the roe of a fish; hence the name from the Greek ὠόν, an egg. The rock is soft, but tenacious and elastic, light in color, admirably adapted for building, particularly of an elaborate and ornate character where much fine carving is desired, and fully sustains the excellent reputation which other stones of this nature, but belonging to a more recent geological horizon, have acquired in England and elsewhere. Our illustration shows the thickness and wonderful regularity of the beds as they appear in the "Hoosier" quarry of the Bedford Stone Quarries Company.

Turning now our attention to the fragmental rocks, the sandstones, we find their distribution the country over more equal than that of any other class. Throughout the entire area of the United States, from Maine to California, and from Canada to Mexico and the Gulf, there is not a state but that produces, or is capable of producing, one or more varieties of this stone in quantity, and of a quality suitable for some form of architectural application. According to the latest available statistics some forty of the states are now productive, representing an invested capital of over $18,000,000 and an annual product of $12,500,000. Those stones most in favor both on account of color and working qualities, and which have acquired a national reputation, are the brown and red "freestones" of Triassic age, and the fine gray or drab sandstones, or *grits*, from the sub-carboniferous formations of Ohio.

FIG. 2.

In the eastern portion of the United States the brown and red sands of the Connecticut valley were long the predominating favorites. These stones, laid down as ferruginous sand and gravel in the comparatively shallow waters of Triassic seas, are essentially granite in mineral composition, although differing greatly in structure, as shown in Fig. 2. The distribution of these stones in the East is limited to (1) a belt of some twenty miles wide along the Connecticut river in Massachusetts and Connecticut, and (2) a belt commencing along the west side of the Hudson river in Southeastern New York, and extending more or less interruptedly for a distance of nearly five hundred miles as far as the deep river region in North Carolina. With the

HOOSIER QUARRY A, BEDFORD STONE QUARRIES CO., BEDFORD, IND.

exception of New York the stone has been quarried to a greater or less extent in each of the states mentioned, and for a time was used in New York City to the almost entire exclusion of all other classes of material, brick excepted. Quarries at Portland, Connecticut, and in New Jersey, in Passaic, Essex, Hunterdon and Mercer counties, were particularly active. Through the early development of quarries at the first-named locality, and the vigorous manner in which work was pushed, the stone quickly became popular, and the name, "Portland brownstone," became early a part of architectural nomenclature. Nearly three million cubic feet of this material were quarried in this state during the last census year, and some six million feet in New Jersey.

A second Triassic belt extends along the east flank of the Rocky mountains, from Colorado southward, and is beginning to be worked in Jefferson county, Colorado, and at Flagstaff, Arizona. Both stones are of a warmer, more red tint than those of the East, and are finding a ready demand, the Flagstaff stone having already found its way as far north and west as Portland, Ore. The only other stones of domestic production at all resembling these, and which are now upon our markets, are from certain of the Medina beds in Northern New York, and the Potsdam beds, in Northern Michigan.

One of the most, if not *the* most important stone of the great central region of the United States is the Berea grit of Ohio. This belongs to the Waverly group of the sub-carboniferous formations, and is a fine siliceous sandstone, of light buff, gray or blue-gray color, of very even bedding and easy working qualities. Although abundantly strong for all ordinary purposes, the individual grains of which the stone is composed adhere with but feeble tenacity, crumbling away readily under the tool, and affording thus a favorable material for either carved or sawn work. The formation from which the stone is taken is from 10 to 75 feet in thickness, and extends in a belt from Williamsfield, in the southeastern corner of Ashtabula county westward into Erie county, thence nearly directly southward in Adams county to the Ohio river. The even bedding of the stone is one of its remarkable features. In some of the quarries of Trumbull county blocks ten feet square and only some 1½ inches thick, have been raised with perfectly flat and even surfaces. In one case a slab 150 feet long, 5 feet wide and 3 inches thick, was reported as raised from the quarry bed intact. In the words of the state geologist, the various layers of stone, although closely compacted are perfectly distinct, adhering to one another "scarcely more than sawn planks in a pile." Although primarily a building stone, this owing to its fine and uniform texture, sharpness of grit and property of not becoming glazed when subject to wear, is eminently suited for the manufacture of grinding and whetstones, which in some cases form no insignificant proportion of the annual output. As the stone lies in the

quarry, different layers are not all suited for the same purposes, as the following section from the reports of the state geologist shows:

	Thickness of Bed.
Drift material	1 to 3 feet.
Worthless shell rock	6 to 10 "
Soft rock for grindstones only	12 "
Building stones	3 "
Bridge stones	2 "
Grindstones	2 "
Building and grindstones	10 "
Building stone	4 to 7 "
Building stone and grindstone	12 "

The view given on opposite page conveys better than can words an idea of the remarkable quarry facilities here offered.

The areas of quarriable slate are coincident with the Appalachian and other mountain systems, the cleavable property which gives the stone its chief value being due to the tremendous squeezing the beds underwent at the time the mountains were uplifted. So far as now known material sufficiently fissile for roofing purposes exists only in Maine, Western Vermont, Eastern New York, in a long belt extending southwesterly through Pennsylvania into Maryland, New Jersey, Virginia, Georgia and Arkansas. In the West and Northwest slates have been reported, or at least sufficiently exploited to demonstrate their value only in Minnesota, Michigan and California. The total capital invested in this branch of the industry is $10,042,293, yielding an output during the last census year valued at $3,444,863 at an expense of $2,823,668.

George P. Merrill.

[TO BE CONTINUED.]

QUARRY NO. 8, CLEVELAND STONE CO., BEREA, O.

CARE AND MANAGEMENT OF BOILERS.

WHILE much has been written upon the subject of boiler explosions there is still a mystery connected with that subject that has never been satisfactorily explained, and probably never will be. Various theories have been advanced, such as the formation of inflammable gases, the crystallization of the plates, and many other theories too numerous to mention, while others attribute it solely to over-pressure. While there is no question but over-pressure is the cause it is not an easy matter to always determine when over-pressure really exists. For instance boilers that have carried a certain pressure for several years and found by frequent tests to retain nearly their original strength have suddenly blown up while carrying a pressure far below that of a recent test. It is true, as a rule, that after an explosion takes place not only the boiler but everything else connected with it is so wrecked that no definite data can be obtained as to the pressure at the time of the explosion, yet there are a few well-authenticated cases in which the engineer and fireman have escaped to testify that the safety valve and steam-gauge were both in perfect order, and that the pressure but a few minutes before the explosion was only normal. In such cases then it is scarcely reasonable to suppose that in a few minutes under such conditions that the pressure would so suddenly increase without any indications from the steam-gauge or safety-valve as to cause an explosion, and the only way in which such explosions can be accounted for is that from some cause the boiler had become weakened so as not to be able to stand the normal pressure. Although low water is attributed as the cause when a boiler explosion takes place, which, unfortunately, is too often the case from the neglect or incompetence of the fireman or engineer in charge, yet we believe where no direct indications of low water is discovered the accumulation of scale upon the inside of the plates had more to do with it than anything else, and instead of formulating intricate theories as to the cause of these explosions it is more important to the engineer or fireman to study and employ such means as will preserve the boiler, and as far as possible keep up its original strength. Very few localities, either in the North or South, will be found where the water is perfectly pure, or sufficiently so as to prevent the formation of scale if used for any length of time without frequent changing. Various boiler compounds have been, and are still advertised for dissolving scale or preventing it from accumulating in the boiler.

But as the nature of these deposits vary with different localities a compound that might possibly be effective in one locality where a certain deposit may exist would not be effectual in another, and in some cases the deposit might be of such a nature that a chemical compound sufficiently strong to dissolve it might be sufficiently so to attack the iron and destroy that also. Now, it is said that an ounce of prevention is worth a pound of cure, and if those formations of scale which are so destructive to boilers and no doubt directly or indirectly the cause of a majority of explosions can be prevented, it is always better and safer to resort to that means than to risk the liability of impairing the strength of the boiler by the use of strong chemical compounds, or in time of destroying it entirely. If the exact nature of the water to be used in different localities and the chemical process by which those deposits were formed were better understood and provisions made accordingly there would be no necessity for the accumulation of any considerable quantity of scale or the use of compounds to dissolve it any further than that which nature has provided in her own great chemical laboratory, and which may be used without any risk of injury. Water in its primitive state is chemically pure, and it is only by coming in contact with mineral and organic matter that it becomes impure, or more properly speaking, impregnated with those substances while passing through the earth. Thus water passing through a limestone formation will dissolve and hold in suspension a certain quantity of lime, and the same is true with sulphur, iron, magnesium and other minerals which are held in suspension so long as the same conditions under which it were impregnated exists. But when water holding any of these mineral substances in suspension is heated to the boiling point the condition changes, the water seems to lose its affinity for the mineral substances which separate and are deposited upon the inside of the vessel in its original chemical state. Now, if pure water has sufficient solvent principles to dissolve and hold in suspension a certain amount of mineral substance in its original state why should it not have the same solvent power over the same mineral substance when separated and deposited upon the inside of the vessel? That it will is a fact that is demonstrated by a common tea-kettle, where hard water is used, and when a thick scale has formed upon the inside the good housewife, without any knowledge of chemistry, will fill it with rainwater from the cistern and after boiling it leave it standing a short time, when the scale will either be dissolved or loosened so that it may be readily washed out. Now, why not apply the same remedy to steam boilers once a week, or at any other stated time in localities where the water is impure and contains a large amount of lime or other mineral substance, and so long as we know that pure water can have no injurious effect upon the iron and will produce the same effect it is certainly a much safer and cheaper remedy than any compound that is sold in

the market for that purpose, the effect of which upon the iron we know but little of. In order, however, to avail themselves of this, nature's best compound, every steam plant should be provided with a cistern of sufficient capacity to afford rainwater sufficient to run the works at least one day in each week, and it must be a very dry time when the roofs of the buildings will not afford that amount of rainwater upon an average the whole year. The proper manner of using would be as follows: The boilers should be blown out every week—Saturday night for instance—under a pressure not to exceed from twenty to twenty-five pounds, and when sufficiently cooled down filled with rainwater from a tank sufficiently elevated for that purpose and allowed to stand until Monday morning, when steam may be got up and if the supply is sufficient the works may be run during the day with rainwater. By this time whatever scale has formed during the past week will either be dissolved or loosened so that when again blown out the boiler will be clean and free from scale.

C. R. Tompkins, M. E.

AN ERA OF COMMERCIAL SYNCOPE.

IN spite of the fact that the exports for the current year has greatly exceeded that of any previous season, there never was so little result, or the profit at so small a margin. And the worst of the situation is that it seems chronic, or the recovery so distant as to reach forward to the time when, by growth of population, consumption will approach production. But the condition is equally severe with other industries. Agriculture, milling, mining, iron and textile manufactures, seem all at a point nearing exhaustion, so far as the amount produced by each interest is measured by profit. The *Tradesman* gives the following resume of the iron situation, that other interests will recognize as fairly to represent their own conditions:

"The maximum weekly output of pig iron was reached in the last week of February, when it was greater than for any previous week in the history of the trade. This product has gradually decreased, and now reported from New York as 16,000 tons less than the largest, and from Pittsburg as 20,000 less. Still there has been no general reduction of stocks on hand, showing that consumption has declined at about the same rate with production. Nor need any considerable increase of takings by mills, foundries, etc., be looked for now, as we are just at the beginning of the hot season, also entering the time of year when general readjustment of wage scales always more or less retards activity. There is some sign of slightly improved demand for special brands but nothing like enough of this to mate-

rially impress the market. There has been no sort of improvement in prices in any of the staple manufactures, and the better demand is practically confined to steel rails and billets. There would seem to be, in the long season of low prices running parallel with phenomenally large production and almost equal consumption, a pretty sure indication that low rates for pig iron have come to stay; and whether bottom has been touched may fairly be doubted. It is now in order for smelters to study economy in every item of their business. The day when 'anything will sell' is gone forever, as well as the day of high prices. In this connection the following table of prices of the several brands of pig iron at the three largest points of consumption, prepared by the *Iron Age*, showing the range in 1891, and for the first four months of 1892, will be interesting:

Pittsburgh.	1891.	1892.
Bessemer pig iron	$16 50	$14 35
Neutral gray forge	13 75	12 75
Muck bar	26 00	25 00
Bar iron, net ton	34 00	32 00
Beams, net ton	62 00	40 00
Tank steel, net ton	42 00	38 00
Wire rods	36 00	32 00
Steel billets	25 00	22 75
Wrought scrap	19 00	17 00
Philadelphia.		
Standard Pennsylvania 1X foundry	17 50	16 00
Standard Pennsylvania 2X foundry	16 50	15 00
Bar iron, net iron	35 90	34 00
Tank steel, net ton	41 00	36 00
Chicago.		
Lake Superior charcoal	17 00	16 50
No. 2 local foundry	15 50	14 00
No. 2 Southern coke	5 75	14 00
No. 2 soft Southern	14 50	13 25
Bar iron, net ton	32 00	31 50
Beams, net ton	64 00	42 00
Old rails	22 75	19 00
Wrought scrap, best	19 00	17 00

"These are average prices. If we had the quotations for the first quarter of 1891 to compare with the first quarter of 1892, there would be a much wider disparity apparent. We know that steel billets, for instance, are now about $6 a ton lower than they were in January, 1891, and the fall in several brands of pig iron has been hardly less marked. The fall in beams—also in billets—during the current year, has been chiefly effected through the dissolution of the combines in those lines, thus making competition free."

THE PROBLEM OF TRANSPORTATION.

WHEN the Creator of the world set New England on edge he laid the foundation for great wealth, untold wealth, as soon as man should find out what the hills contained that could be converted into articles of ornament and utility. Ages before civilization dawned upon this region the rude savages made more or less perfectly constructed weapons of the stones which abounded; but they did not realize that the time was soon coming when every foot of what seemed to them practically useless would be valuable for something else besides hurling at the wild animals which abounded.

The problem of future development has been treated before in these pages and need not be discussed at this time. But the Creator instituted another problem when he made these hills and mountains upon the correct solution of which depends the profitable solution of the first problem. That is the transportation. Transportation in a level region is comparatively easy. There are no hard grades or steep hills to make the hauling of a large burden impossible. It is all on a level and the man in a remote district can compete with his neighbor on practically the same terms, the only difference being distance.

In New England that is different. Scarcely a county but that exhibits both sides. Scarcely a road but has ups and downs sufficiently to discourage any one unfamiliar with such untoward circumstances of Nature. These ups and downs of the road have much to do with the ups and downs of business. When the country was new and all was in the eastern portion transportion was of little consequence because all competed on equal terms, all climbed the hills and all hauled their loads by teams to the market often situated scores of miles away to barter for the family supplies. As long as all were situated alike and team labor was paramount there was no problem to be solved, nothing to do but do as the rest did and receive like returns for labor expended.

But an end came to that sooner than any one could have anticipated, had any one been gifted with foresight to see the development of this country in fifty years. Our forefathers paid no heed to strength or time. They understood but poorly the economy of those two forces in the modern industrial problem, and they continued to lay out their road to

their building over the highest hills there were, seldom or never in the valleys or such level ground as they found. They sought the high land for homes, and thereby doubled the cost of transporting the family necessities. They did not realize that the value of time consumed in hill climbing, the wasting of strength in the same process, and the wear and tear on animals and vehicles were important elements in the production of wealth. All that was left for their descendants to work out after years of labor and difficulties almost insurmountable. But they have found it out at last, and the next fifty years ought to witness important reforms along these lines.

I made the statement last month in STONE that the future of New England depended upon the development of her mineral resources. No one will question that statement and successfully back it up with facts. Yet that is not all. The interest of capitalists may be aroused in a quarry. Plenty of capital may be assured, but the next problem to require settlement is transportation. A quarry located on a hill, miles from a railroad, with the worst imaginable wagon roads stretching between is of no value, even if it contain the best conceivable stone for any particular purpose. Of what use is it if it cannot be economically reached? Business men are not philanthropists that they care to put out money in the development of a quarry, however valuable, unless transportation facilities are somewhere near adequate without the expenditure of thousands of dollars in putting in shape highways which the town or county, as the case may be, ought to maintain in a high state of efficiency.

If the future of New England depends upon the quarries and their development, the future of the quarries depends upon transportation, and the sooner that fact is recognized the sooner will the capitalists be ready to undertake extensive development. The fact must be met and must be overcome. Untoward conditions exist and that existence has serious consequences to answer for in the business development of the buried resources of the six states. When the people become cognizant of the way they are handicaped by reason of poor roads, there is every reason to think that they will demand that something better be provided, and will compel the provision, if those in authority do not attend to it.

The present highway of a New England town is a menace to life and limb. It is almost impossible to drive over it safely with a light wagon, leaving out of consideration entirely, the impossibility of hauling profitable loads to the railroad. The business of road repairs is left to those who have no practical knowledge, and work out their taxes by telling stories and doing nothing at all to the roadway. The cost for the road alone is frightful, ten times the cost of good macadam or other proper material in the end. Then comes the cost of haulage, increased beyond computation, and the whole

makes one of the most appalling wastes this country has to overcome. If an Edward Atkinson can give time and thought to studying the waste in cookery, another Atkinson ought to rise who would figure out the cost of the poor roads.

Without going farther into details I will say again that I believe that the future of New England depends upon the development of her quarries, but beyond and above that the development of the quarries depends upon the solution of the transportation problem.

Burton H. Allbee.

ACTION OF SEA WATER ON PORTLAND CEMENTS.

IN the opinion of Dr. Michaelis, of Berlin, the greatest enemies to the permanency of the Portland cement used in marine structures are the sulphates contained in sea water. If there is any great quantity of alumina and ferric oxide in the cement the structure breaks up sooner than otherwise. This is accounted for by the fact that the sulphate forms with the aluminate and ferrate of lime a number of crystalline compounds such as basic sulphate of lime, alumino-sulphate and ferro-sulphate of lime. These compounds take up a large quantity of water of crystallization so that the total volume is much increased. Hence the weakness and disintegration of the cement structure. Dr. Michaelis considers that the separation of hydrate of magnesia is quite innocuous, for it is only displaced from its solution in the form of a flocculent slimy hydrate which, if anything, is useful in stopping up the pores. His general recommendation to users of concrete for marine work is to choose a cement rich in silica, and as poor as possible in alumina and ferric oxide; and to envelope the structure with an impermeable mixture composed of one part of cement with 2 to 2½ parts of sand of mixed grain, of which at least one-third should be very fine sand, and to this the requisite amount of ballast should be added.

SOME MORE CURIOUS EPITAPHS.

WOULD you go to a graveyard to find wit and humor? Hardly. And yet there are scattered through the graveyards of the world inscriptions which come under this head. Some are evidently meant to be funny, while in others the humor is evidently unintentional. A specimen of the most amazing conceit is found in the epitaph of a Spanish hidalgo, who was musical precentor to the king of Spain. He wrote his own epitaph, and it was placed on his tomb in Saragossa, where it is read by travelers to this day. Here it is:

Here lies John Quebecca, precentor to my Lord the King. When he is admitted to the choir of the angels, whose society he will embellish, God shall say: Cease, ye calves, and let me hear John Quebecca, precentor to my Lord the King.

A New Hampshire epitaph writer makes this bull:

Sacred to the memory
Of three twins of Mrs. Smith.

A Block Island sea captain who had been engaged in the fishing business, wrote this terse epitaph to be placed on his tombstone:

He's done a-catching cod,
And gone to meet his God.

A Mr. Anderson, Provost of Dundee, having shuffled off this mortal coil, it was resolved that an epitaph should be composed by his four surviving colleagues. They decided upon a rhymed stanza of four lines, one to be contributed by each. They put their heads together and with great labor produced the following:

Here lies John Anderson, Provost of Dundee,
Here lies him, here lies He.
Hallelujah, Hallelujah!
A-B-C-D-E-F-G!

This remarkable joint composition was engraved upon the tombstone of the defunct provost, and the composers received a vote of thanks from their delighted fellow townsmen.

In a Western churchyard lies the body of the victim of a stage coach accident with this epitaph on the tombstone:

Weep, stranger, for the father spilled
From a stage coach and thereby killed.
His name, J. Sykes, a maker of sassingers,
Slain with three other outside passengers.

And here is another from the same place:

Listen, mother, aunt and me
Were killed. Here we be.
We should have no time to missle
Had they blown the engine's whistle.

Boston Post.

[Special Correspondence.]

NEW ENGLAND NEWS AND NOTES.

THE lockout and granite situation in New England remains practically the same as last month. A few firms have signed the manufacturers' bill and gone to work and a few manufacturers have signed the men's bill and begun operations. But the main body seem as determined as ever to hold out until forced to do certain things by the sheer stress of circumstances. It isn't safe to predict as to the final ending of the difficulty. Talk with a union man and he will say that the manufacturers are on their last posts. Talk with a manufacturer and he will impart the information that the union will go to pieces inside of a week. The outside public cannot tell and only hope that the stagnating effects of the lockout will be ended before long.

All business enterprises are suffering in the towns where the situation is most serious. The influence of the trouble extends into all sorts of business and ramifies through the entire business world. And yet it is but one industry and body of men.

The *People and Patriot*, of Concord, N. H., a paper which has treated the men fairly ever since the trouble began, advocated arbitration in an able editorial sometime ago, but the manufacturers said there was nothing to arbitrate and the men did not press the matter. Therefore the situation remains as it was weeks ago.

Every day men leave the towns where the trouble is on, going to distant places to work or engage in some other occupation. It has been suggested that the trouble will eventually solve itself in that way, by a general shifting of workmen from one portion of the country to another. Whether such will truly be the case yet remains to be seen. But now the fact is ever present that there is serious trouble in New England's future industry. New England is suffering, not only in pocket just now, but because capital cannot be attracted to the development of her resources as long as there is trouble or any danger of trouble in the stone industry. All friends of New England are looking and hoping for a speedy settlement, but do not now see anything to indicate that it is coming.

A statue of John P. Hale, the first anti-slavery United States Senator, was dedicated at Concord, N. H., Aug. 3. The statue was presented to the state by Senator William E. Chandler, whose wife was a younger daughter

of Mr. Hale. The pedestal is of Concord granite and bears on its face in simple raised letters, "JOHN P. HALE." On the north face is a bronze tablet with the following inscription:

"The first anti-slavery United States Senator. He secured the abolition of flogging and the spirit ration in the navy. Born at Rochester, 1806. Died at Dover, 1873.

On the south face is a tablet bearing a quotation from one of his speeches as follows:

The measure of my ambition will be full when my wife and children shall repair to my grave to drop the tear of affection to my memory they may read on my tombstone: He who lies beneath surrendered office, place and power, rather than bow down and worship slavery.

On the back is a tablet bearing:

Presented to the state of New Hampshire by William E. Chandler.

The completed statue as it stands is the best one of the three in the state-house yard, the one of Gen. Stark being a caricature. Webster's is better, but is not as good as Mr. Hale's. The state-house yard has now four memorials and in all of them Concord granite has a conspicuous place.

Teams engaged in hauling granite from Sodom, near Montpelier, Vt., encounter the same difficulty they do everywhere—poor roads. They are obliged to go a long way around to obviate the difficulty. They would probably be eager joiners of the crusade now going on in STONE for good roads.

New York and Boston capitalists are reported as visiting Copperas Hill in Rutland county, Vt., and though nothing official has yet been given out regarding their intentions it is understood that they will develope the deposit and begin the manufacture of paint. There is an unlimited quantity of it there and the development would mean much to the region round about Copperas Hill.

In the bottom of one of the largest quarries of the Vermont Marble Company at Rutland, Vt., there is now a large quantity of ice. It is estimated that there are fifteen to twenty tons in the quarry. The sun hits it only ten minutes at noon-day.

The granite cutters of Barre have complained seriously of having false reports circulated about them in the press, particularly in the Associated Press dispatches. Very few dispatches dated at either place have been correct. What a newspaper man can hope to gain by false reports is uncertain, but from investigations made by STONE'S representative he is satisfied that the reports are false and that the cutters of Barre are just as firm as they were thirteen weeks ago.

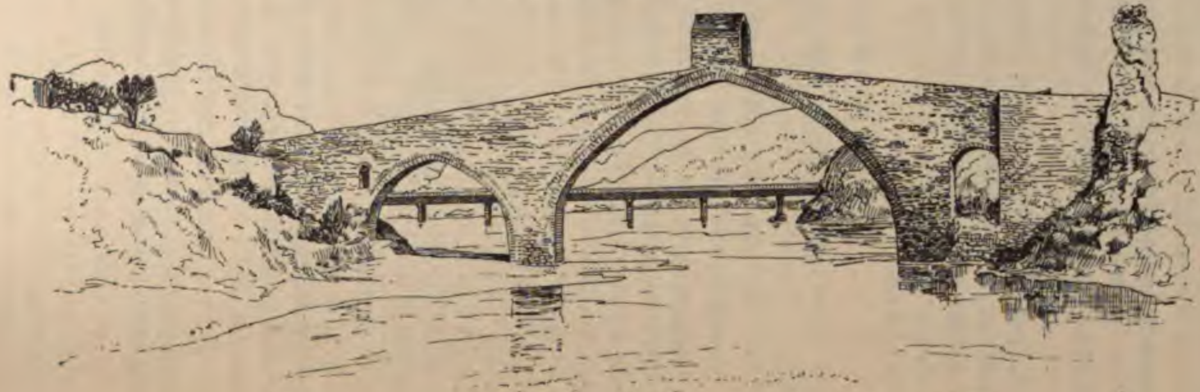
This department of STONE is practically a new departure. It is intended

that a review of the granite and all stone industries in New England will be given each month, the object being to let patrons of the magazine in other parts of the world know what New England is doing and can do. The way to make this department successful is to assist in the work of compiling the matter. What is wanted is short notes of contracts, new quarries opened, and any other matter interesting to those engaged in the stone industry. If there is anything of such a character going on in your vicinity will you not send a postal, with a brief account upon it, to the New England office of the magazine, No. 3 Morrill Brothers' Block, Concord, N. H. It matters not if it is not polished language, it will be fixed up all right for publication. Get the matter all in by the third of the month and let us have a perfect flood for September.

THE QUESTION OF OVERPRODUCTION.

IT has long been a favorite maxim with political economists of the Henry George school that there was, strictly speaking, no such thing as overproduction, since the necessaries of life could never be too plentiful, and that the real trouble lay in the lack of purchasing power on the part of consumers. As the economic world is now ordered it is immaterial which of the two theories be the true one, though the difference is vast so far as a final solution of the problem is concerned. The experience of last year in cotton seems to indicate that any true theory on this score must be founded on an entirely new basis, *and one that commences with the question of profit to the producer.* It seems like irony to say that an over bountiful crop has proved one of the worst calamities that could happen to any country, and yet this is a simple statement of fact as regards the South. If it were merely a question of purchasing power the unprecedented low price of cotton would naturally have stimulated demand, and yet so far from this being the case, it has been difficult to market the crop at any price. Nor is it easy to see who has been benefited in any way by this great crop; certainly the small gain of the consumer has been offset an hundred fold by the loss of every one else—planter, merchant and manufacturer. It is the old paradox of great cheapness being a calamity instead of a blessing, and of demand and supply being badly out of joint with none to set them right.—*Age of Steel.*

A SPANISH RAILROAD BRIDGE.



"EL PUENTE DEL DIABOLO," NEAR MARTORELLI, SPAIN.

SOME SPANISH BRIDGES.

GREAT progress has been made all over Spain in recent years in bridge building. The question often occurs to the traveler, What is the need for such long and handsome bridges? Where is the water? The truth is that for nine or ten months of the year, in most cases, there is no water, and the river-bed is used for cart traffic, forming generally a better road than the ill-kept highways. Suddenly, during the wet season, along comes the rain and melted snow from the mountains, filling the dry bed and often overflowing; sometimes in such volume as to sweep away heavy abutments and piers of masonry.

The first illustration given—taken in the dry season—shows a bridge over the Vilamajor River, on the railroad from Llinás to San Celoni. The river-bed is shown as entirely dry and used as a road. The bridge is a riveted arch truss of 29 meters (95 ft.) span, on masonry abutments; it was built by Sociedad Material para Ferrocarrilesy Construcciones, of Barcelona.

The second illustration is of historic interest; it shows a very ancient masonry bridge near the town of Martorelli in the province of Barcelona, crossing the Noya River. This bridge is known as "El Puente del Diabolo"—the Devil's Bridge—the tradition being that his Satanic Majesty was concerned in its building, and still occasionally shows himself under the archway at the center. This archway—a shelter and toll-house combined—is peculiar, and no similar construction is know to exist elsewhere in Spain. It is remarkable, by the way, how much the devil has been, according to old-world tradition, mixed up in the bridge-building business; there is hardly a country in Europe that has not its "Devil's Bridge." In the more civilized New World, of course our bridge-builders are as far removed as possible from any connection with Satanic or underground influences.

In this illustration, it may be noted that the bridge seen in the distance, through the arches of the old bridge, is the longest railroad bridge in Spain.—*The Railroad and Engineering Journal.*

"Inclosed please find our check for $2.00, being amount for one year's subscription to STONE. Your June issue is a 'daisy.' There is no paper or magazine that we know of, that gives so much valuable information to stone contractors and dealers as STONE. We wish you success in your new venture, hoping stone men generally will subscribe liberally.—*Outhbert & Sargent, Topeka, Kan.*"

A SILHOUETTE IN STONE.

MOTHER NATURE very often unloosens her earth-born dignity, and becomes with her own creations as capricious and fanciful a jade as that most elusive of all loves—the Goddess of Fortune. This argument is well exemplified in a slab of marble owned by Mr. R. W. Barker, the well-known funeral director, and now on exhibition at his office on Eleventh street.

The slab is a sample of the finest Sienna marble, taken from the famous quarries near Lisbon, Portugal. It is a light orange yellow in color, streaked with grayish black veins. These veins form the contour of a woman's head and bust, as true and faithful to life as though drawn by some skillful artist. The features are distinctly Spanish, the hair is dressed low on the brow, and combed up high in the back in the style familiar in the photographs of Carmencita.

The face seems to be half covered with something that might truthfully be defined as a mantilla of black lace, that is wound around the statuesque throat, and falls in a black cascade on the swelling bosom whose outlines are perfectly defined. The eye, half sheathed by the lid, whose dark lashes sweep the high rounded cheek, is dark, and a little imagination could create a langour in its depths.

The whole is marvelous and would deserve a prominent place in the great museums of the world. When you look at the marble for the first time the outlines seem blurred, but after a short time they stand out boldly and clearly, so much so that nothing else is noticed on the slab.

Ma. Barker obtained the stone in a rather peculiar way. He was standing one day looking idly in the big show windows of Barber & Ross' store, corner of Eleventh and G streets. His eye fell on this particular piece of marble, which was one among specimens in the window. The longer Mr. Barker looked the more interested he grew. Mrs. Potter, the artist, happened to pass by, and Mr. Barker called her attention to the stone.

"Look at it intently, if you please," said Mr. Barker, "and tell me what you see."

"Why, it is a woman's head," remarked Mrs. Potter, and she pointed out all the characteristics. Mr. Barker went in and purchased the stone, the salesman wondering what he wanted with a specimen block of marble. When Mr. Barker let the secret of his purchase out, the firm would have gladly bought it back at any price.—*Washington Herald.*

"A NECESSITY TO THE TRADE."

"We highly appreciate the articles published in STONE, and consider the magazine a necessity to the trade.—*Jno. L. Dalot, Addison Point, Me.*"

THE PANIC

I.

IN the morning when the workmen arrive at the shop, they find it cold and dark with a sadness as of ruin. At the end of the long room the engine is mute, with her thin arms, her silent wheels; and she adds to the melancholy, she whose noise and movement ordinarily animate the whole building with the beatings of her giant heart.

The employer descends from his little office. He says with a sad air to his employés:

"My friends, there is no work to-day. The orders no longer arrive; from all sides I receive counter-orders. I shall remain with my merchandise upon my hands. This month of December, upon which I counted, this month of large orders in other years, threatens to ruin the most solid houses—it is necessary to stop everything."

And, as he saw the workmen look at one another fearing to return home, fearing hunger on the morrow, he added in a lower tone:

"I am not selfish; no, I swear it to you. My situation is as terrible, perhaps more terrible than yours. In a week I have lost fifty thousand francs. I stop work to-day in order not to further widen the gulf, and I have not the first sou with which to meet my bills of the fifteenth. You see I speak to you as friends; I hide nothing from you. Perhaps to-morrow the sheriffs will be here. It is not our fault, is it? We have fought to the end. I would gladly aid you to pass the crisis, but I have no longer any bread to divide."

Then he offers them his hand. The workmen press it silently, and during several minutes remain there regarding their useless tools, their hands closed tightly. Other mornings from dawn the files have sung and the hammers marked the rythm. To-day all seem to sleep in the dust of the failure. Twenty, thirty families will not eat the coming week.

Several women who work in the factory have tears in their eyes. The men try to seem firmer. They assume a courageous air and say that one does not die of hunger in Paris. Then, when their employer leaves them and they see him crushed by a disaster greater, perhaps, than he has avowed,

they leave one by one, stifled, the throat tight, cold at the heart, as if they left a chamber of death. The dead; it is the labor; it is the grand mute engine, whose frame shows sinister in the shade.

II.

The workman is in the street, on the pavement. He has paced the sidewalks during eight days, without finding work. He has gone from door to door, offering his hands, his arms, himself, for no matter what need, the most repugnant, the most hard, the most mortal. But all the doors have remained closed. Then he has offered to work at half price. The doors have not opened. It is the panic, the terrible panic which sounds the knell in the attics. The panic has stopped all industries, and money has hidden itself. At the end of eight days it is over. The workman has made a supreme endeavor, and he returns home slowly with empty hands, worn out with misery. The rain falls; to-night Paris is funereal in the mud. He walks in the shower without noticing it, not feeling his hunger, stopping that he may arrive home later. He leans over a parapet of the Seine; the water flows with a sullen sound; the sprays of white foam are torn by a pier of the bridge. He leans further forward. The collossal stream passes under him and sends to him an imperative call. Then he says to himself that this would be cowardly, and goes on. The rain has stopped. The gas blazes in the jewelers' windows. If he were to break the glass, he could take a handful which would give bread for years. The restaurants are lighted, and behind the white muslin curtains he sees men who eat. He hastens his steps toward the Faubourg. Past the bake shops, the butchers, past all of gourmand Paris who displays herself at meal-time.

When his wife and little daughter cried in the morning, he promised them bread in the evening. He has not dared, before the night fell, to go tell them that he lied. As he walks he asks himself how he shall return, how he can tell them in order to give them patience. They cannot, however, remain much longer without eating. He will try, but his wife and child are too delicate. He will try to beg; but when a gentleman and lady pass him and he desires to extend his hand, his arm stiffens, his throat swells, he remains planted on the sidewalk, while the passers, thinking him drunk, turn to see his fierce, hungry face.

III.

The wife of the workman has descended to the threshold of the door, leav-

ing the little one sleeping above. The woman is pale and thin. She wears a calico dress. She shivers in the icy wind of the street. There is no longer anything in the house. She has carried everything to the pawnbroker. Eight days without work is enough to empty the house. That morning she sold the last handful of wool from her mattress. The entire mattress has gone in this way; now nothing remains but the ticking. This she has hung before the window to keep out the wind because the little one coughs hard. Often, without saying anything to her husband, she has hunted work but without success. The panic has hurt the women more than the men. From the stair landing she has heard the unhappy ones sobbing during the night. She has seen one crouched in the corner of the sidewalk; another is dead; another has disappeared. She, fortunately, has a good husband, one who does not drink. They would be beyond want if lack of work had not stripped them of all. She has exhausted her credit; she owes the butcher and the grocer, and she dares not even pass their shops. That afternoon she went to her sister to borrow twenty sous; but she found her, also, in such misery that she began crying without saying anything, and they wept together. Then, when she left, she promised to take her a piece of bread if her husband should return with some.

The husband does not come. The rain falls and the woman takes refuge in the court. The large drops fall at her feet; the dampness penetrates her thin dress. At times she becomes impatient and goes out, notwithstanding the shower, to look for him for whom she waits. When she returns she is drenched. She passes her hands over her hair to dry them. She waits yet, shaken first by chill and then burning with fever. She is hungry. Across the street she sees a bakeshop. She thinks of the little one who sleeps above. At last she sees her husband slowly moving along the street. She runs toward him, and looks anxiously at him.

"Well," stammers she.

He says nothing, bowing his head. Then she ascends first, pale as death.

IV.

Above, the little one sleeps no longer. She has awakened and half dreams, watching the end of a candle which flickers on a corner of the table. No one knows what monstrous and heart-breaking thing passes through the mind of this child of seven years; her face withered and serious as that of a grown woman. She is seated upon the end of the trunk that serves as a bed; her feet hang bare and shivering; her small thin hands gather closer against her breast the rags which cover it. She feels there a burning fire which she would extinguish. She dreams.

She has never had playthings. She has not gone to school because she has had no shoes. She remembers that when she was younger her mother

used to take her to the sunlight. But that is long ago. They were forced to move, and since then, it seems to her that an icy wind has blown continually through the house, and she has never been happy; she has always been hungry. It is a profound thing into which she has descended without comprehending it. Is all the world hungry? She has tried to become accustomed to this, but has not succeeded. She thinks that she is too little; that it is necessary to be grown to understand. Her mother knows without doubt, this thing which is hidden from children. If she dared she

would ask who puts you into the world that you should be always hungry. Then the room is so ugly. She looks at the window where the bed ticking beats backward and forward, at the bare walls, the broken furniture, all that shame of the attic brought by lack of work. In her ignorance she thinks she has dreamed in chambers filled with beautiful objects which shine. She closes her eyes to see it all again. Through her thin lashes the gleam of the candle becomes a splendor as of gold in which she would enter. But the wind blows; such a current of air comes from the window that she is seized with a paroxysm of coughing. Her eyes are full of tears. Formerly she was afraid when left alone; now she does not care. As they have not eaten since morning she thinks her mother has gone out to get bread. This idea amuses her. She will cut her bread into all sorts of little pieces. She will eat them slowly, one by one. She will play with her food.

The mother enters; the father closes the door. The child looks at the hands of both, much surprised. Then when they say nothing, at the end of a moment she cries in a chanting tone:

"I am hungry; I am hungry."

The father drops his head in his hands in a corner of the dark room. He

stays there bowed, his shoulders shaken by the great silent sobs. The mother, suffocated with tears, comes to put the child in bed. She covers her with all that is warm in the house, telling her to be good and sleep. But the child, whose teeth chatter in the cold, and who feels the fire in her breast burn hotter, becomes bolder. She puts her arm about her mother's neck and says softly:

"Tell me, mamma, why are we hungry?"

Emile Zola

ARIZONA ONYX.

ARIZONA onyx is fast gaining a reputation in the East, and the day is not far distant when most of the onyx used in the United States will come from this territory. The great beds of this precious stone in Yavapai and Maricopa counties alone, when sufficiently developed, will supply a greater part of the demand. Even now from two to five carloads are shipped from the Yavapai beds, and arrangements are being made to increase the output, and by the 5th of May, teams will be moving several tons a day from the Cave Creek mines.

The Yavapai onyx beds, owned by W. O. O'Neil and partners, are probably the most extensive mines of the kind known, being almost a solid body one mile by one mile and a half in extent. At present about forty men are engaged in taking out the stone that is being shipped to Chicago, New York, Cincinnati and other Eastern cities, where it is worked into table-tops, etc. Probably the largest slab of onyx ever taken out in one piece was dug out of the O'Neil ledge, it being 10x23 feet, and 26 inches thick. The stone from this claim is very fine grain and takes a much higher polish than the celebrated onyx of Mexico, and it contains colors that were exhausted many years ago in the Mexican mines. Then, too, the mines of that country never turned out pieces larger than five or six feet square. So far as developed, the Cave Creek onyx beds do not seem to be as large as the Yavapai beds, though the stone is as fine, but even as they are, they will produce large amounts and in blocks of very satisfactory size. J. B. Dougherty, of New York, is doing a great deal of development work, and as soon as the road is completed, he will put teams to hauling and loading it on to the cars at Phenix, for shipment to New York.—*Phenix Gazette.*

FUNDAMENTAL IDEAS IN ARCHITECTURE.

A WRITER in a recent issue of the London *Tablet* presents the following remarks on the fundamental ideas in architecture, which are likely to prove of interest to American readers; Leaving aside the battle of styles, what is it in architecture that gives the distinctive mark or idea to the leading styles? Compare the Parthenon at Athens to the Cathedral of Cologne, the Alhambra at Granada to St. Peter's at Rome, and we must at once admit some radical difference in the fundamental idea that has produced such divergent results. The result in each case is a growth, but the idea in the elementary notion of construction has in each case been different.

Art in architecture is the ornamentation of the construction; superadded ornament is either bad art or not architecture. In the development of building the treatment of the three elements of weight, support and security assume different shapes. The employment of ornament, or architecture, came in with the ornamentation of the support, the ornamentation of the weight and the ornamentation of the construction which connected the weight with the support. To arrive at the fundamental idea in the different styles we must examine the relations between the support and the weight.

THE EGYPTIAN.—The Egyptian, the oldest of known styles, placed the weight firmly on the ground. In the first stages of building the strength of materials and the art of construction were but imperfectly understood, and to obtain security masses of material were placed on a broad base, narrowing upward in the form of a pyramid. It suggested security and permanence. The earliest extant monument of the work of man, the Pyramids by the Nile, still rest on the sands of the desert in their majestic massiveness. The Egyptian buildings were constructed on the model of the pyramids. Truncated at various hights, the details and ornamentation, however varied left the same impression of security and permanence. The shelving base from which springs the propylon or porch, the multiplication of short stunted shafts, the shallow reliefs, are all subservent to the one idea. The building rests on the ground, and you know it. The slender obelisk placed in front as a foil brought into prominence the massive solidity of the building. The accessory sphinx, with its front paws placed flat on the pedestal, the body firmly recumbent, and the head solidly draped, was a type of immobility and rest.

THE GRECIAN.—Turn now to the Greek building, with its pediment sup-

ported by three lofty columns. The idea here is the expression of power by the easy lifting up of the weight. The Egyptian represents the mass solidly resting on the earth; the Greek lifted it with ease into the air, and the architectural forms and details were subservient to the idea. The triangular pediment suggests the feeling of pressure downward, the broad architrave and entablature adds mass and solidity, and the moldings and projecting cornice assist the general impression of weight. To resist the downward crush of this mass, the tall graceful pillars rise up to support it, seemingly without effort; the walls are thrown backward almost out of sight that the eye may more readily rest on the work of the columns. The capital, the point of contact or conflict between the weight and the support, is admirably designed to denote the triumph of support; the fluting of the columns tell the eye that there is no undue pressure on the material, and the slight tapering of the column toward the capital suggests that there is power to spare. The Greeks, who were born artists, made the minor ornamentation subsidiary to the general idea; it is neither complex nor elaborate; the upper intensifies the idea of weight; the lower that of easy support. Their buildings suggest repose rather than massiveness, confidence rather than security—the confidence of skill in contest with inert weight.

THE ROMAN.—The Romans imitated the Greeks, and imitated them without appreciating the simplicity of grandeur. They introduced circles and segments of circles in place of the simple restful lines coursing horizontally round the building. They raised columns which supported nothing, simply for the sake of ornament; the dome behind the pediment took away its significance and removed from it the idea of pressure. They adopted the semi-circular arch, which broke the entablature and the idea of solidity, and thus destroyed the fundamental idea of the Greek simplicity without substituting any of their own.

When the Roman style was removed to Constantinople the Byzantines reveled in arch and cupola, but without discerning the real object of the arch. The circular arch distributes the weight of the wall; they refused it the proper office, made it ornamental and concealed the real support of the weight. Consequently, in the Byzantine style we have the domes and cupolas representing the weight with no visible support, and arches multiplied at caprice with nothing to support. The magnificent dome of St. Sophia is poised in the air, traditionally by a miracle, but really by tricks of deceptive material and concealed buttresses.

THE MORESQUE.—The Moresque strove for the negation of the weight altogether; the Egyptain placed the weight firmly on the ground; the Greek lifted it up in the air with an assertion of graceful power; the Romans confused weight and support; the Byzantine represented weight without support; the Moor suggested that there was no weight at all. To produce this

effect the arch is often elongated, its surface broken up by fretted work, its under surface hollowed out, its span divided into small arches. Above it a molding inclosed in a small rectangular space, leaving to the arch the semblance of leisure or sheer idleness. The shafts are so light as to take away the idea of having any work to do. The roof is divided into a series of honeycombed pendants, which confuse the eye and abstract the feeling of pressure. The result is aerial, fairy-like and dreamy.

THE LOMBARD.—The Lombard style, to which our Norman is allied, attended more to truth, and placed the support conspicuously in the wall. Of great thickness, with large blank spaces unpierced and prominent, the walls plainly tell their work and their capacity to do it. The ornamentation is subservient to the idea. Shallow recesses and paneling bring the surface of the wall into prominence; where they are pierced for window or door the beveling and molding in perspective increase the idea of strength, the arcading points to the depth, the circular arch indicates the solidity of the wall above, the circular windows were adapted to emphasize the notion of power. In the Egyptian the wall is unnoticed, in the Greek it receded from view, in the Moresque it is chopped up and scattered, but in the Lombard, without buttress or pilaster, it asserted itself as the main element of support.

THE GOTHIC.—The Gothic, so familiar to us, leaves the impression of ascendant aspiration. The tendency is upward; heedless of weight, it breaks through the weight. The nave rushes upward from the aisles, the tower upward from the nave, the spire upward from the tower. The support is lateral to allow of the upward tendency, buttresses support the sides, the aisles support the nave, flying buttresses hold up the roof. The wall is destroyed, being pierced by window and arch; the arch takes the thrust off from the pillars, and the capitals become mere bands. The windows point upward, the arch points upward, the high-pitched roof points upward. The weight, without being denied, as in the Moresque, is thrust aside, is disturbed over lateral support to allow the upward tendency.

Sufficient has been said to allow of a glimpse of the relations of weight and support in the chief styles, and to indicate how they affected the prominent features. The treatment of each specimen in each style is distinctive, and the infinite variety in form and ornament clustered around the fundamental idea.

A BRITISH VIEW OF RECIPROCITY.

THE system of entailing trade concessions with other nations through reciprocity, is an old one, and its genesis, in the modern sense, is due to the policy of the great Napoleon, although applied and reduced to a science by Napoleon III. But international interest is given to the question by the recent attitude of the United States, and the great measure of its success. Commenting on this the *London Trade Journal* says:

"British merchants and manufacturers are asking themselves whether something could not have been done to prevent the conclusion of the Spanish West Indian treaty between Spain and the United States in its present differential form. It is one result of the failure of British negotiations at Madrid for a renewal of the treaty with Spain, which expired yesterday. To-day, therefore, the new and enormously increased duties come into force in the peninsula, and the United States steps into the Cuban and Porto Rico market, while British goods are shut out. It is a decided victory for the aggressive commercial policy introduced by Mr. Blaine; but it is just possible that the United States has not weighed all the consequences of such a policy. If anything is calculated to goad the British manufacturer into an agitation for retaliation it is just this case of Cuba, upon which the Americans have placed a gigantic and grasping hand. Retaliation we hold to be unwise and useless, but there are signs that its advocates in this country are becoming numerous and influential. In Birmingham, whose idol a few years ago was John Bright, the tariff committee of the Chamber of Commerce has recommended that the government be urged to retaliate by increasing the duties on Spanish productions, and though the council of the chamber rescinded this resolutiou the fact that the committee adopted it is most significant."

THE ST. LAWRENCE QUESTION.

THE retaliation against the Canadian government for its practical violation of the treaty of Washington, in the matter of granting rebates to Canadian vessels through the Welland canal and the St. Lawrence river, that in effect imposed a toll of two cents per ton on Canadian shippers and eighteen cents per ton on Americans, has awakened the Canadians to a sense of the magnitude of their mistake, although there are not wanting expressions of jingoism, that to Americans has a serio-comic aspect—comic to Americans and serious to Canadians, as a contemporary has wittily expressed it. The recent bill passed by Congress and the President's message has roused grave apprehension among Canadian vessel owners. The steamer Rosedale, owned by Hagarty & Co., and costing $100,000, is too long to be

brought down through the St. Lawrence canal and would have to tie up. The Algonquin, owned by Thomas Marks, of Port Arthur, and costing about the same, would be in a similar predicament. The imposition of the toll would also probably lead to litigation, because most of the charters have already been made under the impression that the tolls would remain the same as before. The aggregate loss to Canadian vessel owners, if the full toll be imposed, would undoubtedly be up in the millions. It is understood that the contractors for the Canadian Soo canal have proposed to complete it for traffic within a year on the payment of $250,000 extra. W. W. Ogilvie, the big miller, said:

"The operation of the bill will not seriously affect the trade of Montreal or the Dominion. American vessels can now go and discharge at Kingston and get their rebate the same as Canadian vessels, but if we are to allow them to go and discharge in Ogdensburg, it would virtually hand over the St. Lawrence river carrying trade to the Americans. The same people could not work on American barges without living in the United States and becoming American citizens. Although all our canals and rivers are open to Americans, they still keep the Whitehall and Erie canals and the Hudson river closed against us. Our barges have to tranship at Whitehall, while theirs load anywhere in Canada and go through to New York. Still they say that they do not discriminate against us. Taken altogether, if the Canadians are wise they will pay no attention to the Americans."

John Torrance of the Dominion Steamship Line, said:

"Ocean and inland carriers will have to bear the burden. Till the Sault canal is finished the weight will fall seriously on those named, and hence of course, on Montreal and its forwarding interests. Still I am not for abating a jot of Canada's title in question. The conduct of the Americans in shutting us out of the Whitehall and Erie canals is of itself enough to point to without anything for the justification of what the Americans term discrimination against them."

THIS EVER-CHANGING WORLD OF OURS.

"STONE," on one or two occasions, has criticised the views so long held by geologists that the igneous and metamorphic rocks were a clear evidence of a molten interior of the earth, especially as volcanic action seemingly demonstrated the existence of rocky material in a melted condition. But there is every reason for believing that all of the crystalline rocks have been deposited from aqueous, or at least liquid solutions, and that the metamorphism has been a result of subsequent action. Few of the deposits forming the earth's crust remain in the condition in which they originally were deposited, and these are comparatively recent formations. It is more than probable that every portion of the earth's crust has successively undergone a change from a condition where acid or alkaline solutions that form the bases of quartz, and the clay rocks, as mica, feldspar, and the limestone and magnesian series, have, through chemical crystallization, been deposited as the granites and marbles, or by erosion and recementing, into the slates and sandstones, or by organic transformation into the limestones, and then by the unequal pressures locally exerted on the strata, have developed sufficient heat to metamorphose them into gneiss and schists.

The process is continuous and is in constant operation. Complete igneous metamorphism would produce a conglomerate containing all of the material for any of the existing rocks, and these materials gradually being dissolved in aqueous solution, are again separated into their several characteristics by the selective process of chemical crystallization, or low forms of organic life, to again undergo erosion and separate deposition. It has been generally maintained that granite is the result of crystallization from perfect fusion, although this would seem entirely disproved by the existence of some of the mother liquor in the center of the quartz crystal, and that could not have formed at a temperature higher than 94° Fahrenheit—a degree of heat far too low to produce fusion.

But the heat exists, as volcanic action shows, and that temperature increases one degree for every fifty or sixty feet, has led to the assumption that the interior must reach a molten temperature at no great distance below the surface. But this view is due to an improper conception of the properties of heat, so-called. Heat is not a tangible thing, but is a form of molecular motion, and the more freedom there may be for a molecule to

move, the more that motion is made evident as heat. As pressure increases the amplitude of molecular vibration is lessened, and the exponent, as heat, is reduced in the same degree, and if a pressure could be imagined that would cause the molecules to absolutely touch, and so destroy their vibration, we would reach the absolute zero of temperature. But now suppose this pressure were to be suddenly removed. The vibrations would begin again and increase in energy, and to its extent it would be manifested as heat. The shrinkage of the earth's crust from any cause in any particular direction would relieve the pressure in some other direction, and if the relief were sufficient, we would have a temperature capable of fusing any substance composing the earth's solid crust.

This view is the only one that answers to the data of modern observation and science, although it introduces some singular paradoxes. The latest view of matter adapted by chemists and physicists is that the individuality of the various elements is due to a certain individuality of the motion of an atom, and therefore that matter need not be of more than one material, and even that one manifest only by its motion. If the absolute zero could be reached, and all motion be destroyed, it would have no property whatever, and would not exist. The thing itself seems impossible, and exists only in the mathematical imagination, like infinity.

In the bottom of the great oceans that are constantly being fed by materials brought down by rivers and glaciers the process of sifting out and metamorphosing is now going on, probably nearly as it has during past geological ages, and the only element required to account for any of the geological phenomena is time, modified perhaps by varying changes due to climate and even to cosmical action, and in which all temperatures and pressures are involved to assist in the modification. New limestone strata are being built by zoophytes out of the lime carbonate in the sea water which has not only this but silica and alumnia in solution as well as in mechanical suspension. The entire Allegheny system is slowly sinking, while the sierras of the Western slopes are rising. In time what is now the sea bottom will emerge, as the continents slowly sink, and as these involve varying pressures, volcanic action will modify the sediment of successive portions, giving rise to the metamorphorism, until lately ascribed to a period when the entire earth was in a fused condition—a condition which, if it ever existed, was so exceedingly remote as to cover many eras of such geological changes as we now observe, but which are seen to be only a part of the same processes now in action. One may begin at any point in the geological investigation only to follow it over and over again in an endless series of change.

H. C. Williams.

A PECULIAR MONUMENT.

FOR some time, says the Baltimore *American*, the decision of the Maryland Historical Society to erect a handsome monument on Guilford battlefield, in North Carolina, to the memory of the soldiers of the Maryland Line, who fought and died there on March 15, 1781, has been slowly bearing tangible fruit, until now the work is so far advanced that the dedication of the monument is announced to take place, with impressive exercises, some time in next October, possibly on the anniversary of the surrender of the British at Yorktown, or of the burning of the steamer Peggy Stewart, at Annapolis. The bronze castings of the monument have been completed, and are now in Baltimore.

The monument will be rather peculiar in shape and something out of the ordinary. It will be a simple granite block, rough and unchiseled, and cubic in shape. Its dimensions will be six feet by four feet by four feet, and it will be placed on a circular mound to give it the appearance of greater height. This block is now being quarried at the Woodstock granite quarries. On two sides of the block will be fastened bronze plates, two feet square, one bearing the coat-of-arms of Maryland and the other this inscription:

MARYLAND'S TRIBUTE TO
HER HEROIC DEAD.
Erected by Members of the
MARYLAND HISTORICAL SOCIETY,
In Memory of the
SOLDIERS OF THE MARYLAND LINE.
1781—1892.
Non Omnis Moriar.

These plates are works of art, and were designed by Dr. Fulks, of this city. They were moulded in Philadelphia, and are now at the office of W. Hall Harris, where they have been viewed by many of the members of the society. The granite block will soon be ready for shipment.

The result of the battle of Guilford Court-house is well known, and the part the Maryland troops played in the engagement was most important. Their lines were the most advanced; their fighting most determined and effective. Gen. Greene, commander of the forces, said of Lieut.-Col. Howard, who commanded the regiment, that he "deserved a statue of gold." Maj. Anderson, who served through so many engagements, fell on this field, and his body lies buried there.

The question of erecting this monument has long been under consideration by the society. On the 8th of last June a committee, consisting of Edward Graham Davis, Bradley T. Johnson and W. Hall Harris was appointed to consider the question, and ascertain its practicability. This committee corresponded with the Guilford Battle Ground Company, which owns the historic field, and were offered a site for the monument. Under the

recommendations of this committee, which was also constituted a building committee, the society determined to erect the monument on the position held by the Maryland regiment during the battle, and the building committee prepared the designs.

It was hoped that the monument could have been erected in time for dedication on the anniversary of the battle, but delays in getting out the granite and moulding the bronze rendered this impossible. The society will make extensive preparations for the event, and will take a large delegation to the battle-field on the day of the dedication. The orator will be a Marylander, and the exercises will be most impressive.

THE ARROWHEAD DAM.

IN a pamphlet recently read before the Engineers' Club of Cincinnati, Col. Latham Anderson discribed a dam about to be built by the Arrowhead Reservoir Company, Little Bear Valley, Cal.; the object is to store the water of the Mohave River to irrigate a large district near San Bernardino.

On account of the configuration of the valleys very short dams will be required, extending between the steep rock slopes of the cañon, on either side. The granite of which these slopes are composed forms excellent material for masonry, but the soil in the neighborhood does not afford material suitable for puddle ; also, on account of the frequency of earthquakes in this part of the continent, it was considered unsafe to rely on a purely masonry dam.

To meet all the conditions, the following type of dam has been proposed by the writer: The water face of the dam to have a face of masonry on a slope of ½ to 1 of a uniform thickness, to act as a retaining wall when the reservoir is empty. The thickness calculated for a dam 150 feet high is 10 feet. This masonry is to have a dry backing 2 feet thick with the joints well filled with cement mortar 3 or 4 inches from the lower face. A tile underdrain is extended along the bottom of this wall, with outlets under and across the dam, and discharging below its foot at regular intervals of height. The dry wall thus acts as a drain to the masonry above it. This composite wall rests upon an earthen dam. Instead of being spread in layers in either of the usual methods, the earth, granite bowlders and gravel are piped into place by the hydraulic method. The wall is first carried up as high as it can be safely built on this slope without support. When a section of the wall is finished to this height the earth backing it is filled in to within a few inches of the top of the wall. Another section of the wall is then built and

another filling of earth piped in; this process being carried on to as high a level as it is practicable to pipe the earth. It is expected to be possible to construct the dam in this manner to a height of 125 or 150 feet, above which level the earth filling will be made of the same material as below, but in one of the usual manners, probably with wire rope and trolleys. The lower slope will be kept in shape by dry stone facing carried up as the piping proceeds.

With water convenient, under a good working head, the earth can be filled in at from 4 to 5 cents per cubic yard. The upper portion to be filled in by cable will probably cost from 20 to 25 cents.

The wall is to be concrete filled in with large blocks of granite, the joints in no case being less than 2 inches thick. The facing, 10 feet thick, is to be of large blocks of granite rubble laid in cement mortar with ¾-inch joints. The material, including blocks of granite weighing four to five tons each, is to be distributed on the wall by wire rope and trolley.

The cañon has bare rock walls so nearly vertical that the dam is only 50 feet long on the bottom and less than 200 feet at the height of 125 feet The thickness of the dam on the bottom is over 90 feet. It has a slighty arched plan in form. Its total height is to be 150 feet. The upper 25 feet traverses a long granite ridge after leaving the cañon. The plans, it is understood, are shortly to be carried out and the dam built.

"FOOTPRINTS IN THE SANDS OF TIME."

QUARRYMEN operating in the Portland sandstone quarries in the Connecticut valley, recently blasted out a block, 130 feet beneath the earth's surface, that was spotted with very interesting and curious marks. The marks, according to scientific men, are footprints of the anisichnus deweyanus, which was very popular in the valley several million years ago, the beast being a combination crocodile-bird.

It is the opinion of Prof. William North Rice, of Wesleyan University, to whom the fossil slab was sold for $100, that at the time the deweyanus flourished there was no Connecticut river, but in place of it a bay that was fifteen miles wide, extending from the sound to the border of Massachusetts. In that epoch, a good many million years since, this crocodile bird used to bathe in the bay, then come out of it, shake himself and gambol awhile on the plastic micaceous sand, then on top of the earth; and so he left his mark on it. In time the sand became gelid, the world grew over it and now workmen toiling in the bowels of the earth 130 feet below its surface came on the playground of the anisichnus deweyanus; and a professor

studying the tracks imprinted in the sandstone, is able to tell just what sort of a creature strode about in the Connecticut valley when Time was a babe. Wonderful, indeed, is the eye of Science, even when it wears spectacles and follows the humdrum vocation of teaching the modern dude.

The fossil slab which is of invaluable worth to geologists, is to be sent to New York to be exhibited there.

GRANITE AND THE TARIFF.

EVERY day brings fresh refutations of the false pretene of free-traders that New England industries are being killed by the tariff.

At Barre, Vt., there are large deposits of granite. Its excellent quality has been known for fifty years or more, but all through the revenue tariff period it remained comparatively undeveloped. But during the last twenty years quarry after quarry has been opened, and the product has found way all over the country.

The McKinley tariff increased the duty on dressed granite from 20 per cent. to 40 per cent. No consumer pays any more than he paid before, but he buys more. At a recent banquet in Barre, S. D. Allen, as reported in the Barre *Enterprise*, said:

> One hundred and one dwellings in twelve months is the added number to the buildings, $275,000 in wealth of real estate, and 1,000 to her population. The building material used would fill 700 freight cars and require 21 engines to haul it here by rail. We have more lawyers, more ministers, more editors, and more merchants than last year. We have shipped 5,315 carloads of granite from Barre in twelve months, which would form a train thirty-five miles long and build a wall three feet wide and eight feet high from here to Middlesex, a distance of twelve miles.

What is true of Barre is true of Concord, N. H., Quincy, Mass., Westerly, R. I., and many other places. There is nothing like a great, protected and prosperous market for the development of natural resources, the employment of labor and the building of towns.—*Home Market Bulletin.*

THE MAN OF MANY PRICES.

ONCE upon a time there was a small butcher with a great head for business, and one fine morning when he had employed a clerk, he ended his list of instructions as follows:

"This is prime rib; Johnson, twenty-two, Harland twenty, Musgrove eighteen, Lister sixteen—"

"What do you mean?" demanded the new clerk.

"I mean," replied the long-headed butcher, "that my prices are made according to the way in which I am paid. Johnson pays every six months, and therefore his beef costs him twenty-two cents. Harland pays every four months and gets his beef for twenty cents. Musgrove pays every two months and that brings the price of his beef down to eighteen, while Lister pays spot cash and gets his for sixteen."

The clerk smiled at such a queer system, for he was unused to the ways of the country. But his smile was even broader and sweeter when his employer said:

"Always charge the Rands twenty-eight cents for prime rib."

The clerk commenced repeating the table of names and prices, school-boy fashion, much to the delight of his new employer, and when he ended with Rand, twenty-eight, he was prompted by curiosity to ask:

"How often do the Rands pay?"

"Well," replied the butcher, as he stroked his long, gray whiskers reflectively, "I have to sue the Rands for my money about once a year."

The obvious moral of the foregoing little fable is that if we would work on the plan best adapted to success in life, we should always pay spot cash. It also teaches us that we should never seek accommodation at the hands of people who only accommodate us in order to accommodate themselves; and even as it is a sound, time-honored business rule to take our goods to the best market, so should we always go to the best market to supply our needs, and not patronize the man of many prices, and by paying him spot cash, pay the bills of others who never pay at all.

R. K. Munkittrick.

A BIT OF HISTORY ON A BIT OF STONE.

MR. EDGAR BATES, of Angola, Ind., a geologist of some reputation, while in Jackson county, Michigan, a few days since in quest of specimens, happened upon a quaint and highly interesting one in the way of a bit of slate stone. While strolling along a stream his ever-ready eye fell upon a peculiarly shaped stone which seemed to have been cut by some blunt instrument. Picking it up he noticed what had at one time been a plain, bold hand-writing engraved upon the stone, but which had so worn by constant contact with various substances as to render the inscription too dim for the naked eye to read. However, with the aid of a pocket glass, he was able to make out the following:

Samuel Bernet: I was taken by the Indians near Sandusky, and I never expect to reach that place. If my friends ....
I am to be burned. .. ..
April 16, 1809...

For proof of the genuiness of the relic, Mr. Bates says that the entire state of Michigan has no slate to speak of and none of this particular kind whatever, and that during his many previous visits to Jackson county he never saw slate of any kind within its bounderies, while Sandusky, O., and roundabout abounds in slate of this description.

In conversation with him he remarked: "It is indeed a relic, and one which I highly value. I do not for a moment doubt but that this is the last pitiful message of one of those sturdy pioneers who unflinchingly met the blow of the deadly tomahawk, or braved death at the stake without a murmur."—*Universe Cleveland O.*

PRESERVATION OF STONE.

LIMESTONES are for many reasons, eminently suitable for constructive purposes, being cheap and easily worked, but they readily absorb moisture. This as it usually contains carbonic acid, gradually dissolves away the material of the stone, and in winter serious injury is often caused by the freezing of this water and its consequent expansion. Several methods of rendering this material porous have been proposed, but not infrequently has the remedy been worse than the disease. Alkaline silicates were at one time in favor for this purpose, but in its application, soluble hygroscopic alkaline carbonates are formed which seriously affect the utility of the process. Moreover, unless care is taken in the application of these silicates a hard impervious varnish is given to the surface of the stone, within which the water in dissolving the silicates is imprisoned, and on the first frost serious disintegration takes place. M. M. Faure and Kessler have recently been at work on this question and as a result of their ex-

periments recommend the use of metallic fluosilicates, more especially those of aluminium, magnesia and zinc. The surfaces to be treated are brushed over with a solution of salt, causing on the first application an abundant froth, due to the liberation of carbonic acid gas. When dry the operation is repeated once or twice, depending on the quality of the stone, on an average for soft stones 1.7 pounds of solution to 40° Beaume are required per cubic yard. The advantages are: that the process is completed in twenty-four hours; it allows the stone to be polished, by a suitable choice fluosilicate used, different colors can be communicated to it; and lastly, the process is cheap, and applicable not only to stone, but to all cements and mortars containing lime. The theory of the process is, that a double decomposition occurs, forming in the first place, silica, calcium, and aluminium flourides, and carbonic acid gas; secondly, a reaction takes place between the limestone and the aluminium flourides, producing aluminium flourides, producing alumnia, calcium flouride, and carbonic acid. In this manner each grain of the limestone is covered with an insoluble coat, materially increasing its resistance to atmospheric influences.—*Engineering*.

CLEANING THE STATUES.

"ARE ye painting them figgers?"

The inquirer was a stranger; and he addressed his query to a man who was about to climb over the fence which surrounds Greenough's struggling frontiersman and Indian on the east front of the capitol, says the Washington *Star*.

For some weeks past two men have been hard at work removing from the marble group on each side of the eastern portico the grime which previous mistreatment had permitted to lodge thereon. Hundreds of lookers-on and passers-by have wanted to know how the statues were being made white. Were they being painted? Was the surface being cut away? Was acid being used? Not one in a score of the questioners guessed accurately. There was neither painting nor cutting nor acid erosion.

Many years ago these same groups took on a somewhat smoky hue, and they were treated with a chemical compound that gave them a yellowish tinge, and worse even than that, ate into the marble until the surfaces were minutely but effectively honeycombed.

"Not a line of the marble is damaged," said one of the restorers to a *Star* reporter who had climbed up alongside of him to see how the thing was done. "With these little tools"—displaying three or four varieties of small steel implements—"we scrape off this deposit, which causes, in fact is, the

discoloration. It is simply an atmospheric deposit, dust and rain. It lodged in the honeycombed surfaces, and is about one-sixteenth of an inch thick. Occasionally," and he ceased conversation while he scraped a narrow streak of darkness off one of the Indian's exposed ribs, "the thickness is greater, but you will notice that this is only so in the folds of a garment, where both dust and moisture accumulate.

"All foreign matter is scraped off, and when that has been thoroughly done the surface is carefully sand-papered. The marble is not injured in the slightest degree; look at the first lines and find a scratch if you can. Lots of people imagine we are doing the groups some permanent injury, and some of the hard-headed ones continue to think so even after we have explained the method to them."

These same two workmen cleaned the Persico group of Columbus and the semi-nude female, who is apparently watching to see what sort of a curve the Genoese discoverers is going to give the baseball-like globe he holds in his uplifted palm. Persico's figures of "Peace and War," located in the niches alongside the eastern doorway, have also been somewhat renovated. Just now they all have a decidedly new and pleasing appearance. After a while a couple of Architect Clark's artisans will give George Washington's marble image—the big Greenough statue on the east front—a good scrubbing. It needs no scraping, because it escaped the acid treatment, and is therefore amenable to bristles and soap.

LEGEND IN MARBLE.

SCULPTOR RIORDAN, of Deadwood, has completed the Sioux Indian maiden statue upon which he has been working for some time. The statue will be a part of the women's exhibit of this state at the world's fair. Mr. Riordan took for his subject a Sioux maiden named Minnehaha, in connection with whose life and death there is a romantic legend.

Minnehaha was the daughter of Sitting Bear, and her birth-place is credited to the Black Hills, but the family moved to a reservation in the Eastern part of the territory (this occurred in about 1870), near an Agency where United States troops were stationed. Minnehaha fell desperately in love with Lieutenant Dupont, a tall, noble, stately looking fellow, and was unhappy when out of his sight. Dupont was married, and did not reciprocate the love, and endeavored to induce her to go away, but she would not. She could not comprehend the matrimonial laws of the palefaces. She requested to be made his servant, that she could be always near him to wait upon him and to shield him from the treachery of the Indians.

Dupont could not bear to see her sorrowful face, and thought if he was

out of the way she would soon forget him and would dispel her mad passion, so he applied to be moved to Fort Laramie, Wyo., and the request was granted. He then quietly moved to his new station. He had been there over a year, and had entirely forgotten Minnehaha, when one night he was called to his office to see a visitor. Upon entering he saw a female standing beside the fire-place, her head bowed, and upon her face was an expression of great sorrow. He stared in wonder at her for a moment, when Minnehaha, for it was she, said :

"Oh, Dan, don't you remember me any more? I walked all the way from Dakota to die in your presence. Oh, Dan, don't drive me away; I've only got a few more days to live. My heart broke when you left me. Circumstances compelled me to live with my people, but we had nothing in common; their way was not mine, and now that I am dying I want to be buried among the palefaces, and I will die happy to think that you will sometimes come to my grave and pity poor Minnehaha."

Eleven days later the soldier tenderly laid poor, broken-hearted Minnehaha under the sod on the little hillside near the fort, and a pine tree was planted at the head of the grave. The tree still marks her resting-place. The above legend is frequently told around the camp-fires of the Sioux.

SIMPLICITY IN COMBINATION OF FORMS.

A FOREIGN critic has truly said that the mingling of columnar and arcaded arrangements in the same composition appears to have been the grand cause of the deterioration of Roman architecture. It occasioned unequal and inordinately distended intercolumniations and broken entablatures; these a vitiated taste repeated where the necessity that had first occasioned them did not exist, and harmony and simplicity being thus destroyed the practice of the science went on deteriorating till it was made to produce such monstrous combinations as the palace of Diocletian at Spalato, and the temple of Pallas or ruins of the forum of Nerva in Rome present. It was indeed a fall from the grandeur, harmony and noble simplicity of the interior of the Pantheon in its pristine state to the hall or xystum of the Baths of Diocletian, which now exists as the Church of Santa Maria degli Angeli, with its straggling columns and broken and imperfect entablature, or from the temple of Jupiter Stator to that of Concord or the arch of Septimus Severus.

MRS BEMIS' SEED-CAKES.

HORATIO BEMIS had been to the lodge, and perhaps that was why his appetite was poor next morning. "Things don't taste as they used to," he began. "Besides, I get tired of toast. Now there was mother—" Mrs. Bemis, across the table, set her lips and looked into her plate.

"Mother," he resumed, "had a way of fixing up things. Such omelettes! And then, her seed cakes! We had them for breakfast and supper, and we used to take them to church. Sermons were so long we hadn't time to go home between morning and afternoon meeting, so we ate lunch in the pews."

"My mother used to make seed, cakes too," replied Mrs. Bemis, "but they always seemed monotonous."

"Then they couldn't have been good. I could eat them morning, noon, and night. Would, too, if I had a chance."

Mr. Bemis' birthday occurred about a week after this dialogue. When he went to breakfast his wife gave him a tidy to wear on the back of the rocking chair and a door-mat for the hall. Mr. Bemis thanked her for these reminders. Then she said:

"Horatio, I have another surprise for you. Look!" And reaching into the pantry she produced a great tray filled with seed-cakes.

"Well!" exclaimed Mr. Bemis, admiringly.

"You've spoken so often of those seed cakes that I wrote to your mother and asked her to make up a good, big lot for you. This isn't a quarter of them. I think she must have sent a bushel. Now, do eat them, Horatio. It will please her so much."

"It will please me, too, Monrovia."

"I'm so glad. The express came to $2.40. If it hadn't been for that, I should have got you a box of cigars."

"What, for $2.40?"

"Certainly, Horatio."

Mr. Bemis buttered a potato, but, although he affected a sprightly air in doing so, he was seen to tremble. "I would rather have the seed-cakes, if it's the same to you," he said in a hollow tone.

"You must write your mother a good, long letter of thanks," pursued Mrs. Bemis.

"Of course I will. Oh, this tastes like home," said Mr. Bemis, smiling,

with a seed-cake between his thumb and finger. "Fresh as if they had just come out of the oven. We must have them on the table every day, Monrovia. And don't give too many to little Archibald."

"Very well, Horatio. And I'll put up half a dozen for your lunch."

Mr. Bemis had seed cakes with every meal for two days. On the third day he said:

"Monrovia, I'm afraid those seed-cakes are getting dry."

"It isn't possible," answered Mrs. Bemis, "for I've kept them in the hall closet, and you know how damp and cool it is there."

On the fourth day, when Mr. Bemis noticed that the cakes had become damp, Mrs. Bemis cried:

"Dear me! I'll give them ten minutes in the oven at once."

On the fifth day Mr. Bemis suggested,

"Suppose we have doughnuts for breakfast, for awhile."

Mrs. Bemis' tone was doubtful:

"Why, of course, if you wish, but you enjoy the seed-cakes so that it's hardly worth the trouble. You wouldn't want them and doughnuts too, and I don't care for doughnuts, myself."

"But little Archibald might like doughnuts."

"He prefers oatmeal. And he is getting to be such a manly, generous child, Horatio! On the first day I let him have seed cakes and he cried for more, but I told him they were for you, and that papa would be sorry if his boy ate them all up. Next day I gave him two and the day after that only one. Yet he hasn't cried for them since. Isn't that good of him?"

"It is. I'm afraid he is almost too good."

On the sixth day the head of the family sat eying his half-finished breakfast with gloom.

"What is the matter, Horatio," asked his wife. "Don't you feel well?"

"Pretty well. That is, no."

"I was afraid of it. For the last three days you've been buying lunch down town, instead of taking it with you. One never knows what he gets in those dreadful restaurants. And, beside, they're so expensive. You know we must have a new carpet for the parlor next month, and we must live rather plainly for a few weeks. Here's your lunch box. I've put in eight seed-cakes this time, for you must not stint yourself in the matter of food."

On the seventh day, after laboriously eating his breakfast, Mr. Bemis stopped in the hall to play with little Archibald. The howls of his offspring brought the mother to the rescue.

"What is the trouble with mamma's pet?" she asked.

"Papa tied to make 'ittle Artibald eat seed takes," sobbed the infant.

"I only offered him a couple, Monrovia. I don't see why he takes on so. The child ought to have a little variety in his diet, I should think."

"Not at his age, Horatio. Besides, his stomach is not strong, and those seed-cakes are rather rich."

"That's so; they do want a stout stomach."

"They are very well for grown people. As soon as these are gone I'll get your mother's recipe and make a fresh lot, with not so many seeds in them."

Mr. Bemis hurried away. In the evening his wife greeted his return with:

"Oh, Horatio, the grate is broken in the kitchen, and I had just fire enough left to make tea, but it went out before I could cook anything, and we shall have to make our dinner on seed-cakes."

When his wife went down to set the table Mr. Bemis went into the closet where the winter clothes were kept and fell on his knees, remaining in that position until the bell rang. At the table Mrs. Bemis said: "Horatio, you wrong me by eating so little. Don't you think you ought to take something for it?"

"Thank you, Monrovia; I believe I would like to take something; say ham and eggs."

"I think you need good, plain food. You ought to try to eat as many seed-cakes as possible. They are excellent for the health, and just think how it will please your mother to know that you ate them all. Take a couple more; do, Horatio, oblige me by taking a couple more."

"They must be nearly gone, Monrovia."

"Not half of them. You shall have them with every meal for a month to come."

When Mrs. Bemis went into the kitchen to get some milk for little Archibald, her husband took advantage of her absence to rest his head against the wall and groan. He felt badly about something. Next morning when he descended to the dining-room, his wife said:

"That miserable stove-man did not come to fix the grate, and I've had to make coffee over the gas. How lucky it is that we have all those seed-cakes in the house."

"Won't there be anything else this morning, Monrovia?"

"Not this morning, Horatio."

Mr. Bemis grew pale, but he ate his breakfast—not much breakfast; a little breakfast—then he lingered around until he saw his wife engaged about the dishes, when he kissed her good-by, slipped into the storeroom, got a

valise, went into the hall closet, staid there for half a minute, went out, closing the door softly, and hurried away to his office. In the evening, when he came home, his wife was sitting on the doorstep.

"Why," said she, "what are you doing with that valise?"

"I—er—. Fact is, my dear, our office boys have excited my sympathy for a long time. Their parents are poor, and I am sure they seldom have dessert at lunch, except when they lunch on pie. I took down a few seed-cakes for them, and it was touching to see how they appreciated them."

Mrs. Bemis arose and went to the closet. Then she looked him in the face and said, in a tone of amazement and reproach:

"Horatio Bemis!"

"Huh?" he replied, with simulated innocence.

"If you haven't gone and given away half of those seed-cakes! There aren't enough left for a week."

"Is that so?"

"Indeed it is. You are so reckless, Horatio. You can't have them for lunch any more. I must keep all that are left for your breakfast and dinner."

They went down to the table, and after the meat and vegetables had been disposed of, the seed-cakes were placed before Mr. Bemis. He took one and began to nibble, but it seemed to stick to his teeth, and he had difficulty in swallowing. Then he remarked in a surprised way:

"Look here, how does it happen that you are not eating any of these."

"Because, I want you to eat them all yourself. (Mr. Bemis sighed.) "Besides, I do not care for seed-cakes."

Mr. Bemis arose, took the cake that he had been trying to eat, and hurled it at the marble mantelpiece, shivering it—the cake, not the mantelpiece—into fragments.

"I do not believe I do either," he said. "I ought to have cut loose from them a week ago, but those seed-cakes undermined my strength. It would be suitable at this moment to speak some loud, strong language, but those seed-cakes have destroyed my spirit. Monrovia, give those seed-cakes to the poor, and do it this evening."

"Horatio, I am astonished at you."

"Well, I am astonished at myself, to some extent. I never was proud, but I was not humble enough until about Tuesday to believe myself an ass. Now it's Friday. You can't imagine my state of mind during the last three days."

"But you said——"

"Never mind what I said. I am older than I used to be. Don't let me see another seed-cake for the next seven years. If you'll only do that, I'll never mention mother's cooking again. I will even help to eat hash on Mondays."

"Thank you, my dear. I have a strawberry short-cake in the kitchen."

"I've been punished enough, Monrovia. Bring it in."

C. S. Montgomery.

THE COLORADO STONE INDUSTRY.

IT is difficult to write of the mineral resources of Colorado without an enthusiasm which is susceptible of being taken as part of the exuberant gush so often imputed to local descriptions emanating from the Far West. Yet it may be affirmed, with due regard to moderation, that no division of our country has a more diversified range of mineral products, some of which are almost unique and confined to the state, while others are present in great abundance and need only better transportation facilities, a wider market, and the enterprise to fully develop and utilize them. In the popular estimation Colorado is a land of silver and gold mines, producing also notable quantities of lead and copper in connection with the precious metals, with sufficient coal for local consumption, and some iron. Beyond this, ideas are vague, though tourists carry back with them specimens of many rare and strange minerals and ores usually regarded as mere curiosities. This is a very impertect view of the case.

Among the common yet most valuable substances are a wide range of building and ornamental stones, in great variety and of unusual excellence, the profusion of which is in marked contrast to the barrenness in them of the almost level expanse of plains country to the east and southeast, where the flat topography and the deep alluvium are against practicable quarrying of the underlying rocks, chiefly unaltered sedimentaries. In Colorado, on the contrary, the foothills along the flanks of the continental divide and the mountains themselves furnish exposures of rock conveniently accessible for attack, and where the geological conditions have resulted in a diversity of lithological characters.

In 1891 the values of the output in Colorado of the four leading metals were: Silver, $22,767,370; gold, $4,498,865; lead, $5,473,255; copper, $733,-653, and an undivided remainder bringing the total up to $33,548,934, without counting coal and iron ore. What the value of the stone production amounted to is not known with any degree of precision. A fair, but confessedly rough, estimate places the annual output of building stone at about $1,700,000 net at the quarries, and worth something like $3,000,000 in the market. Statistics of stone are very hard to obtain and far from being reliable. These figures seem small in comparison with those for the metallic production; yet they are by no means insignificant, considered as representing what is not much more than a beginning. It may be worth while to

briefly outline the present state of the stone industry, and consider the cause why this interest, based upon practically unlimited resources, has not been carried to a higher degree of prosperity.

Thus far the sandstones have received the most attention. They occur in great variety of color, hardness and degree of lamination, but throughout the same strata are remarkably persistent in uniformity. The compact red sandstone found in heavy beds is a favorite building material in the larger towns of the state, and has been shipped to Chicago and other cities eastward as a material for substructures and for trimmings. It has a rich warm color, is of even firm texture, and while easily carved into delicate tracery possesses great strength, and (so far as experience goes) durability, not weathering and flaking off with the grain. There are also extensive beds of laminated sandstone of even cleavage which furnish superior flagging and curbing; and a red sandstone is quarried for block paving, which possesses great resistance to abrasion, while, not wearing smooth, it offers a good foothold for draft animals. It is used also for the toothing about car tracks in streets paved with asphalt. It breaks readily into rectangular blocks on the cleavage planes, but has sufficient cohesion for durability. Besides a limited use in Denver, it has been shipped to Omaha, Kansas City, etc. Gray, buff and bluish sandstones of pleasing tints are found in abundance and are used in building, but not to the same extent as the red stone. The light colored stones seldom contain minerals which by decomposition on exposure to the weather cause stains and discolorations; but of course some selection is necessary. Larimer, Jefferson, Fremont, Boulder and Las Animas counties have many sandstone quarries. A white sandstone said to be suitable for glass making is also found all along the eastern and western bases of the mountains and in the latter. Quartzite is another common rock of this group, but little used for building.

The granite of Gunnison county and other localities is slowly coming into use for foundations and substructures and for a few complete buildings. That used in the new state capitol is of a light, even gray, and can be had in sound blocks of indefinite size.

Limestone and dolomite are of common occurence and available in almost every county, but not so largely used for building purposes as the sandstones. The limestone is burned for lime for local use and is also largely employed as a flux in the smelting furnaces. It is of different degrees of hardness, graduating into true marble by local metamorphism. Cement rock is abundant and is sparingly utilized.

Marble in great variety, white, clouded, mottled, variegated and of almost all the plain colors, occurs in many places, sometimes in very heavy beds, as in Larimer, Weld, Chaffee, Jefferson, Gunnison and Pitkin counties. It seems strange that it has not been more largely utilized as a building stone

and for interior decoration. The finer grades would bear shipment over long distances in competition with Tennessee colored marbles.

A light-colored rhyolite, locally known as "lava," makes a handsome building stone and is used to a moderate extent. It is a good material and its peculiarity renders it attractive as a contrast to the ordinary run of materials. Slate for flagging and roofing is found, but is little developed. Serpentine occurs as a mottled stone, suitable for ornamental uses, in Park and Gunnison counties. Gypsum occurs in the Jurassic and Triassic of many localities, and in El Paso county it is made into plaster-of-paris. Material for whetstones and grindstones has been discovered. There are veins of fluorspar in the Archæan rocks of Boulder, Jefferson and San Juan counties. Glass sand, building sand and sand and massive quartz for refractory linings; chalk; pottery-clay, fire-clay and red brick and terra cotta clay; mica; infusorial earth; mineral paints; graphite, etc., are useful substances found in abundance. To this imperfect list of mineral products, other than the better known metalliferous ores, might be added also a large number of gem, semi-precious and ornamental stones, among which are topaz, phenakite, garnet, amethyst, rock crystal, rose quartz, smoky quartz, chalcedony, jasper, onyx, sard, carnelian, agate, moss agate, agatized wood, obsidian, etc., etc. Enough has been said, however, to indicate that there is no lack of variety in the stones and mineral substances suitable for structural, ornamental and other kindred purposes.

Stone is by far the favorite building material in the older and larger towns of the state, Denver in particular possessing many fine mercantile buildings of stone, with perhaps a better display of stone dwellings in good architectural taste than other cities of equal population in this country. But the whole local consumption is not large in proportion to the extent of the material at hand; nor is there any important demand in the adjacent states and territories, so that an outside market has to be looked for. The export trade is steadily though slowly growing, and Colorado building stone is seen as far east as Chicago and beyond, while toward the Gulf another promising field appears to be opening, especially in view of the scarcity of good stone in that direction. There are large possibilities for the extension of the Colorado stone trade; but thus far neither the technical methods of quarrying and handling nor the commercial enterprise in pushing the sale of the product have sufficed to place the industry where it should be. Backwardness in this direction is perhaps to be accounted for by the predominant interest felt in the precious-metal mines of the state, which have hitherto monopolized the larger share of attention. As the country grows older and becomes more densely populated, other industries will gain in attractiveness and importance. Colorado is still very young, and is only beginning to draw upon her natural resources. Last year a good deal was said about the

exhibit of Colorado stone proposed to be made at the Columbian Exposition. For one thing, the state building there was to have been constructed entirely of native stone. That project has fallen through, and the house is to be mainly of "staff." This failure would not have been of much consequence (seeing thatthe state building is apart from the main exhibition buildings) were a worthy representation to be made in the mines department, where it properly belongs; but it is now feared that a satisfactory exhibit will not be made there. The money allotted by the legislature for the total expenses of the state exhibit seems to have been frittered away in entomological collections, wax fruits, etc.; while the mineral interests have been left to take care of themselves. The public spirit of the mining men will bring out a magnificent but not wholly adequate showing of the ore minerals; but the quarry exhibit seems predestined to be relatively a failure. A proper exhibit of building stones involves considerable expense in collecting, dressing and handling, and should include heavy material difficult to transport, besides calling for the exercise of technical skill and taste. All this means good organization, executive judgment and system on the part of those having it in charge. It is hardly likely that the unaided and undirected efforts of the quarrymen will make up for this official neglect. Colorado depends upon her mineral resources for prosperity and well-nigh for existence, but does not seem to realize it; and in this instance has let petty politics and favoritism mismanage what ought to have been, and might have been, an exhibit creditable to her position.

The quarry owners and stone dealers of Colorado have had a state stone association for some time, with headquarters at Denver. Its annual meeting was held in Denver, July 8, in pursuance of a call which stated: "If our organization is to be maintained and work continued, we shall need the presence of our wisest counselors and strongest men to devise a plan of campaign and assume the responsibility of directing affairs in the crisis we have reached." The present officers are: Geo. L. Kimball, president; G. T. Nelles, vice-president; G. E. Trowbridge, secretary; John T. Drenan, treasurer.

During the past two years a fight has been on in regard to street-paving in Denver, which city is making extensive improvements in this line. But the asphalt-paving people have been much shrewder and more enterprising than the stone producers, and gained a decisive start at the outset by beginning a well-planned canvass and subsidizing the press. Asphalt-concrete has been laid in some of the principal streets and is now being put down in others covering the greater part of the business quarter of the town. Some of the earlier asphalt paving was so poor that it has had to be torn up and replaced, while the work as a whole has been scamped. The citizens who looked for asphalt paving equal to that of Washington and Paris have

been disappointed. Some of the streets of Denver carry a very heavy traffic (machinery, castings, stone, wholesale goods and the like) requiring a solid and durable pavement. In addition to the small amount of stone-paving previously done, property owners representing 20,000 feet of frontage have called for a sandstone block pavement, and owners of another group of lots having 11,000 feet frontage are in favor of stone. This, however, is a comparatively small proportion of the work to be done. As in other cities lately or now undergoing the same experience with their street-paving, the asphalt interest has been managed with much adroitness, leaving the other systems almost out of the competition.

Albert Williams, Jr., E. M.

SLATES AND SLATING.

THE best and most substantial roof known to the architects at present, says a writer in an English exchange, is the slate roof having at least a square pitch. Such a roof weighs considerably more than a shingle roof, and it also costs a little more, but it is many times more durable.

Some queer technical terms are used in connection with slating. Names are used to indicate the size of slate. One 10×13 inch being known as a double. Smaller slates are called small doubles. The next larger size is known as plantations; the next size is called viscountess. Sizes ranging from 8×12 inch to 10×15 inch are called ladies; from 10×20 inch are called countesses; up to 14×24 inch, which are known as princesses.

There are slates that run through all the titles of the nobility—marchioness, duchess, imperial—and then comes what is probably a poor man's slate, under the delicate title of rags. The noble titles are again resumed, and run queens, empresses, and end with princesses.

In American practice the slates run simply by inches, from 7×14 inch up to 17×24 inch. The thickness of slates ranges from 0.125 to 0.3215 inch, and their weight varies from 2 pounds to 4½ pounds per square foot. A square of slating is rated as any other roofing equal to 100 square feet, the gauge is the distance between the courses, while lap is counted as the distance which each slate overlaps the slate lengthwise next below but one.

Lap varies from 2 to 4 inches, and a standard lap is about 3 inches. As above stated, a good slate roof should have about square pitch, but slates should never be put upon a roof which pitches less than 1 foot in 4 feet. When it is desired to compute the surface of a slate when laid and the number of squares of slating, subtract the lap from the length of a slate which is taken as distance from nail hole to tail, and one-half the remainder will give length of surface exposed; this when multiplied by width of slate will give the surface required.

To ascertain the number of slates required for a square, divide 14,400, which is the area of one square in inches by the surface obtained above, and the quotient will give the number of slates required for one square. For an example, take a slate 12×24 inch, taking a standard lap 3 inches, the number required for a square will be found by subtracting 3 from 24, equal to 21, and 21 divided by 2, equals 10½ inches, which multiplied by 12 equals 126 inches, 14,400 the total area to be covered, divided by 126 which equals the area of one slate, gives 114, 29 inch slates required for the square.

Slate weighs from 165 pounds to 180 pounds per cubic foot, and, in consequence of lap, it requires an average of 2½ square feet of slate to make one inch of slating. When slate 0.125 inch thick is laid on laths, it weighs

4.75 pounds per cubic foot; when the same is laid on 1 inch boards, it weighs 6.75 pounds per cubic foot. Slate 0.1875 inch thick on laths and boards weighs 7 pounds and 9 pounds respectively. A 0.25 inch slate weighs 9.15 pounds and 11.25 pounds respectively. The thickest kind, gauging 0.3215 inch, weighs 11.15 pounds and 14.10 pounds on laths and boards.

A slate roof composed of 6×12 inch slate weighs 1680 pounds per square, and requires 480 slates. A 10×20 inch slate weighs 6720 pounds, and requires 171 slates per square. A 12×24 inch slating requires 125 slates and weighs 4480 pounds.—*Carpentry and Building*.

A JOKE GRAVEN IN GRANITE.

THE potent, grave and reverend trustees of the new public library building in Boston, were paralyzed, and the good plebeians and patricians of the modern Athens were shocked in their finest sensibilities by the discovery that a practical joke had been perpetrated in granite and served up to them by an architectural wag. On the left-hand corner of the eastern face of the building are chiseled the names: "Moses, Cicero, Kalidasia, Isocrates, Milton, Mozart, Euclid, Æschylus, Dante, Wren, Herrick, Irving Titian, Erasmus." It was sometime before the incongruity of the chronological disorder in which the names were placed attracted the attention of a youthful Harvard undergraduate, who brightly solved the enigma, and startled his fellow-citizens with the discovery that the initials of the names as above quoted formed the words McKim, Mead, White, who were the architects of the building.

The Hub was tired.

The descent to punning slang is expressive of the utter abasement of cultured, critical Boston. But that blot upon its 'scutcheon must be obliterated. The trustees dashed impetuously to the rescue. A drumhead special meeting was called. Resolutions of censure, indignation and finally of retaliatory action were passed. In a brief space a hundred stone-cutters were slashing and hammering the names of that granite tablet, and reducing the graven characters to the "vile dust from whence they sprung." McKim, Mead, White were soon totally blotted out, and Boston breathed again.

An esteemed daily contemporary in the world's fair village by the shores of Lake Michigan makes a suggestion to the Boston library trustees which is good enough to repeat here:

"The acrostic which a waggish firm of architects placed upon the new public library building of Boston has now been removed after much indignant discussion·

"Upon the facade of that structure the names of several great men had

been arranged in such a manner that the perpendicular rows of letters spelled the firm's title. The tablet has been torn down and another will soon be put in its place.

"To do away with all offensive suggestions of advertising, and at the same time meet the poetic requirements, the following arrangement of illustrious names has been suggested :

Bion.	Beethoven.
Aristides.	Emerson.
Keppler.	Angelo.
Euripides.	Nelson.
Dante.	Schopenhauer.

"The names are inspiring, and the esoteric message they bear exhales the savory aroma peculiar to Boston life. Glancing at the one the mind of the passer-by would be stimulated, and taking in the deep significance of the other, the cravings of his physical being would be met and profoundly satisfied."

This is a Roland for the Oliver which Boston gave Chicago when one of its æsthetic journals called the Columbian Exposition "Chicago's big pig fair."—*Architectural and Building Monthly.*

TESTING CEMENT.

ROUGH testing of cement, so as to enable a workman to get a crude and imperfect idea of its value, is easy, says the Popular Science Monthly. Enough of the pure cement should be taken to make a ball an inch in diameter, an mixed with just sufficient water to make it mould readily and be rolled into a ball. Then it should be exposed to the air and left for two hours. At the end of that time it should be set ; then it should be put into water and left. It should grow gradually harder, and show no signs of cracking or crumbling, even when left for ten days. Any cement that does not endure this test is not of sufficiently good quality to make satisfactory structures ; any cement that stands this properly will be generally satisfactory if properly used. In determlnining how to construct a building, a series of tests is often required that shall show tensil, breaking, twisting and crushing strength, and also adhesion of the materials used for the mortar. No one of these can be dispensed with, since material that will indure one satisfactorily will often fail utterly in another, and hence prove worthless for the use desired ; but for general purposes the test of cement, which is the most valuable, is that which determines its tensile trength.

THE MONARCHY OF MAN.

LET me say that the co-operative system of industry is demonstrably successful. I cite the whole world to the greatest and most successful flour manufactory in the world. Persuade the Pillsbury, if you can; persuade their co-operatives, if you can, to go back to the industrial system which they have abandoned. They will not do it. Ex uno disce omne—out of one instance learn the possibility of everything. If the laborer is to come up it is by this road. If any industry be so vast and varied that co-operation is not applicable thereto, then the industry is too vast and varied for either private or corporate management. It belongs to society as a whole, to the government, if you will, to be managed in the interest of all. I repeat that, according to my judgment, the new era is at the door, and that the wage system of labor, inherently vicious as it is, must give way to some form of co-operation more generous and ennobling. There is in this world one thing to be considered, and that is the people. There is one kind of interest and right to be consulted, and that is the interest and right of the masses. There is one kind of monarchy to be established throughout the earth, and that is the monarchy of man.—*Prof. John Clark Ridpath.*

THE USE OF FORCE SHOULD BE ABANDONED.

A WRITER in *Carpentry and Building* offers some very sensible objections on the labor question, that indicates reason for the distrustful, and even warlike condition that exists in the building trades and elsewhere. "The average employer in the building trades has, at some time or other during his business experience, felt the pressure of the action of the labor unions in their efforts to improve the conditions under which their members perform their work. The average employer has also been in the habit of allowing such matters as do not directly affect his relationship with an owner to take care of themselves, and has made no effort to prevent customs which he knows must ultimately be changed from becoming fixed. He has conducted his buriness entirely upon the assumption that when he is pushed into a corner or when conditions detrimental to his business become fixed, he would make a grand overthrowing of things generally and start afresh. In the meantime the workmen have been steadily and systematically pushing ahead, gaining ground here and there, a little at a time, firmly establishing their organization and continually progressing toward their desired goal. Until recently they have met with so little

rational opposition and have found so little desire on the part of employers to seek out and maintain right and justice for both sides, that they have come to look upon every point gained as an evidence of the justice of their position. They have undoubtedly encroached upon the prerogatives of the employer in some cases, which is not unnatural, considering their strength in numbers and in unity of purpose. They have had no one to point out to them wherein they have assumed too much as their own right, for the action of the employer has generally been one of resistance rather than one of assistance or direction. No equitable conditions can be established between two parties when one of the parties is less attentive to existing conditions than the other. A satisfactory adjustment of the labor problem will not be secured until the employers are sufficently well organized to treat with the organizations of workmen upon some other basis than that of opposition. Until the use of force is abandoned and the two interests meet on equal terms, no reasonable or just solution of the question can be expected."

THE ONLY STABLE FRAME.

THE triangle is the only framed shape that cannot be pushed or pulled out of shape without breaking the joints or distorting the sides. The square can be worked about its joints as pivots, until it is flat and its sides inclose no area; but the triangle allows no such liberties taken with it.

"EACH NUMBER BETTER THAN THE LAST."

"Inclosed please find $2.00 to renew my subscription to your excellent paper. Each number is better than the last and contains valuable information in regard to stone, and items of interest to everybody. Wishing STONE the success it deserves."—*John B. Sullivan, Taunton, Mass.*

DISTRICT ASSOCIATIONS.*

THE Marble and Granite Dealers' Association of Ohio, has been severely criticised by some of its members for its action in adopting the report of the committee relative to the formation of district associations. The principal argument offered against the effort is based upon the failure of certain local associations to keep alive and retain their organization. It should be borne in mind, however, that such local organizations have endeavored to thrive without a competent head or sovereign power to direct the movements thereof, and their circle of influence was encompassed by narrow limitations. In their condition, there have been none to look after their interests outside of their immediate circle, nor to encourage them to keep alive.

Their material and specific interests have been left to no one in particular, but to all generally, each supposing the other would attend to certain duties of vital interest to the whole. This only furnishes a striking proof of the old and homely adage "that what is everybody's business is nobody's business," and the proof is found in the utter failure of all associations which seek to live under similar conditions.

If any one will glance at the history of our benevolent associations, whose great and glorious work is seen and felt from one end of the universe to the other, and see with what care the sovereign power of each looks after the interests of local branches of the order, he will assuredly discover, that with only a meager portion of the energy, wisdom and oversight displayed by these bodies, our district associations, under the care and watchfulness of the parent association in the state, which is or should be subordinate to the national association, that all our interests will be linked together and our benefits and assistance be assured because of the common bond of interest that is a part of the vitalities of all.

Organization is the parent of prosperity, and is only another name for method, and correct methods always bring prosperity. We are surely in the correct channel now, our interests from the quarrymen and manufacturers in the East to the humblest dealer in the West, and all along the line, are identical, and that which affects one portion affects all.

The day when a few men can control the trade is gone by, and the honest

*A paper read before the Marble and Granite Dealers' Association, of Ohio, at Toledo, O., July 12, 1892, by I. H. Kelley, secretary.

small dealer who does business on true business principles can rest assured that so far as his capabilities permit, and his wisdom and energy will assist him, he can claim and receive all that he is entitled to. But men are not all alike in the monumental business any more than they are in the field of literature and politics, and they are "weighed in the balance" and some are "found wanting." Different natural conditions curtail our powers of labor and limit our successes to a proportion based upon the means and energy employed. Success depends upon strong individuality, both of mind and body, and because we may not succeed so fortunately as our neighbor, it is no assurance that we have been wronged by him, but the rather that we have not been up and doing to the full extent of the opportunities presented. Nor can this or any association make a success for its members, only in so far as it stands as the guard of true business honor, and throws around each the mantle of its power, giving every one an honorable and equal chance in the race of business life.

Here the province of the association ends, and each one is called upon to put forth his own powers, and prove himself a man in all the honorable capabilities the term implies.

Association engenders and fosters fraternal regard, removes the bitterness of heated competition, and makes us willing to regard the universal right of all to "live and let live." The world owes no man a living; it is his duty to earn it, and to-day there lives not a being who has honestly earned his living that has not been more than paid.

The short existence of our own association where it has been permitted to exercise its beneficent influence through the aid of those who compose its membership, is a striking proof of these conclusions, and if we could only point to a full determination of all to live up to the true line of action, waiting patiently for the full fruition of promised hopes, its complete realization would be an after-thought filled with the utmost gratification. No longer would we be pointed at by the more harmonious and successful industries as a business of secondary or minor consideration; no longer would we be content to house ourselves in out-of-the-way, tumble-down places of business, but our pride of vocation would soon lift us to a higher plane and we would occupy in the heart of the public a respectful place, be designated as honorable business men, whose honor for the vocation is asserted and held up by those who are engaged in it.

In the nature of things there should be no industry known to men that should call forth a higher respect than our own. We seek to keep alive by our labors, all that is most sacred in the human heart, the sweet memories of those loved ones who have "gone before." Our work calls forth the tears of sweet remembrance, the tenderest feelings of the heart are made manifest, and should we not have places of business where those who seek to honor

their lost friends may not be shocked by rude and uncouth surroundings? Much more, then, should we be men whose business capacities and methods are free from the striking characteristics of greed and avarice, but full of sympathy and condolence in such hours of trial.

It is true that business is for profit and not for sympathy alone, yet the two can be so linked together that the former is only the more assured by its respect for the latter. It is the absence of the latter so strikingly observant in the majority of cases that has cast reproach upon the vocation.

The great desire to out-do or over-reach our competitors has made us the "observed of all observers" and branded us as "vampires," as living by the misfortunes of others and regarding no one but ourselves.

But a better day is dawning. Already public sentiment is giving us honor for our efforts in the cause of reform, and many a hearty "God speed" is offered by thoughtful men.

And there is an evidence of great satisfaction that the more earnest workers and thinkers in our trade are recognizing these truths and are "lending a helping hand" by their influence through the word fitly spoken, the kind act done or the financial aid generously contributed, to bring about so glorious a result.

The district or local association is now the pivotal point on which our fullest success is assured. Guided and directed by the state association, which in turn receives its strength from the national association, all moving under the grand principle of sovereignty, "The consent of the governed," a principle which has made our republic the greatest nation in the world, we are bound together by a system that cannot fail.

Therefore let our counsels be harmonious, and our efforts strong. Let all join hand in hand to accomplish the good work; let none shirk duties which for the present may seem onerous and heavy; and the future will bring us out of the "slough of despond" into the pure sunlight of business success and prosperity; then will our minds and hearts be elevated and we will stand as "men among men," in our own estimation, as well as in the estimation of an observing public.

SUBMERGED MASONRY.

IN works which are exposed to the action of the sea or the currents of rivers, Rennie adopted the plan of bedding the outside of joints, for about an inch deep, in the face, with Roman cement of the best quality. The interior part of the stones was bedded in mortar, composed of two parts of well burnt stone-lime, one part of ground puzzolano, or calcined pounded iron-stone, and two parts of clean sharp river sand, not too fine. The lime was used hot, for which purpose it was necessary that it should be burnt adjoining the works, and mixed at once with its due proportion of sand and puzzolano, or iron-stone, previous to being slaked. It was afterward covered over with sand, so as to prevent the access of the air; water was then poured on the heap, and in this state it was left for a day or two until completely slaked; after which it was taken from the heap as wanted. The unslaked particles were separated, and the other ingredients well mixed, by being passed through a screen, after which the mixture was made into mortar, with the least possible quantity of water, by means of a pug mill, prepared for that purpose.

SEVEN THOUSAND MILES A MINUTE.

A COMET has recently appeared in the heavens which according to Professor Barnard, is peculiar in that it possesses a complicated sys tem of tails, instead of the single member characteristic of most comets. A photograph of the body shows at least a dozen distinct branches, or tails, spreading out from the head. One of these tails was formed, or projected, to a distance of about 10,000,000 miles in less than twenty-four hours, while another one entirely disappeared in the same time. Such inconceivable velocities only add to the mystery surrounding these strange visitors to our system, and raise the question whether they indicate an actual projection of matter, or the illumination, or rendering visible, of matter previously existing but unperceived by us.

A GEOLOGICALLY REMOTE LAND.

IN is life forms Australia is known to be strangely different from other lands, and reasons have appeared for looking upon it as a survival of the secondary and tertiary periods—a region that has grown old less rapidly than the rest of the world. "We know," observes a writer in *Science Gossip*,

"that within the period called tertiary, gum trees, banksias, Moreton Bay pines, and other now distinctly native Australian trees, grew in England. In the secondary period the only warm-blooded mammals in Europe were marsupials, resembling those peculiar to Australia. Every now and then some new fossil mammal turns up, but it is almost certain to be of the Australian type. For instance, a large number of fossil mammalian bones have just been discovered in the tertiary strata in Patagonia, and they have been proved to be nearly related to the pouched or marsupial wolf (Thylacinus) of Tasmania."

DIAMOND MINING IN SOUTH AFRICA.

THE De Beers and the Kimberley mines are probably the two biggest holes which greedy man has ever dug into the earth, the area of the former at the surface being 13 acres, with a depth of 450 feet, the area and depth of the latter being even greater, says Lord Randolph Churchill in the August number of the *Popular Science Monthly*. These mines are no longer worked from the surface, but from shafts sunk at some distance from the original working and penetrating to the blue ground by drifts at depths varying from 500 to 1,200 feet. The blue ground, when extracted, is carried in small iron trucks to the "floors." These are made by removing the bush and grass from a fairly level piece of ground; the land is then rolled and made as hard and as smooth as possible. These "floors" are about 600 acres in extent. They are covered to the depth of about a foot with the blue ground, which for a time remains on them without much manipulation. The heat of the sun and moisture soon have a wonderful effect upon it. The blue ground from Kimberley mine becomes quite well pulverized in three months, while that from De Beers requires double that time.

INDISPENSABLE TO THE TRADE.

Your June number of STONE just to hand; the change is quite an improvement, and we consider such a magazine indispensable to stone dealers and quarrymen. Everyone should subscribe.—*The Georgia-Quincy Granite Co., Macon, Ga.*"

VARIOUS STANDARDS OF TIME.

AT the poles where all meridians converge, there can be no natural standard time, for it is every hour of the day at once; but the regulation of time at these singular points has not yet become a burning question, says a writer in *Nature*. Were the system of time-reckoning recommended by the Prime Meridian Conference carried out in its entirety, the minutes indicated on all regulated clock dials throughout the world would be the same at a given instant, but the hours would differ at each 15° of longitude by steps of one, twenty-four standards encircling the globe. Thus for example, at 25 minutes past noon of the prime (or rather the zero) meridian, clocks 90° east would show 6:25 p. m. (18h. 25m.); those 90° west, 6:25 a. m. (6h 25m.), and those of 180° 25minutes past midnight. The zero meridian adopted by the Prime Meridian Conference is that of Greenwich; and definite time standards based on hourly intervals from this starting line have been in use since 1883 on the railroads of North America. That continent is divided into strips of 15° in width, in each of which a separate time standard prevails from the Gulf of Mexico to Hudson Bay. Atlantic time in the Eastern Province of Canada and in Newfoundland shows 8 a. m. at Greenwich noon; Eastern time in the Atlantic States of the Union marks 7 a. m. at the same moment, while Central Mountain, and Pacific time indicate, respectively, 6, 5, and 4 a. m., The meridians which set the clocks across America are those of 60°, 75°, 90°, 105°, and 120° west.

The conditions in Europe are more complicated in America. Each small closely peopled country, with its national observatory, naturally tends to adopt throughout its particular national time, although even this is still a desideratum in some. In the difficult subdivisions of Imperial Germany especially, the number of independent and unrelated standards was a grievous obstacle to the interpretation of through railroad time tables.

The British islands, lying at the extreme West of Europe, should logically keep time of the zero meridian, which intersects Greenwich Observatory, while the Russian Empire (in Europe, at least) was by its system of central government and state control of railways equally committed to the time of St. Petersburg. But Pulkova Observatory lies two hours East of Greenwich plus one minute and a quarter, and the alteration required is so small that it may be said already to constitute East European time, two hours in

advance of Greenwich, or the standard time of West Europe. The meridian of 15° E., running through Norway, Sweden, Germany, Austria and Italy, corresponds to Central European time, one hour in advance of that of Greenwich; and if national prejudices and local inertia were overcome, the time of Europe would be placed on a simple footing by its adoption. The railways of Austria-Hungary have used Central European time on this system since Oct. 1, 1891. More than fifty towns in the monarchy have since then regulated their clocks to correspond, Vienna being the only conspicuous exception, where local time is used for local purposes. Servian time tables have been assimilated to those of Central Europe and Bulgarian to Eastern Europe; while Turkey, pulled two ways, yields on both sides, following Central European time on the Salonica railway and Eastern European time on the Constantinople line.

In Sweden railway time has been that of Central Europe (15° E.) since 1879, and in South Germany the change to the same standard took place April 1, 1892, a fact of much greater importance, because a feat very difficult to accomplish. The four standards of Bavaria, Wurtemberg, Baden, and Alsace-Lorraine were previously in use concurrently, and the change involved retarding the nominal hours of all trains from fourteen minutes in the case of Bavaria to thirty-four minutes in that of the Reichsland. Luxemburg came into harmony with the rest of Central Europe at the same date, with the loss of thirty-six minutes.

By a decision of the Federal Council in May last mean solar time of the fifteenth meridian will become standard time for the whole German Empire April 1, 1893, when it exclusively will be employed for railway, telegraph, and all state purposes. Already several places in North Germany have adopted the new time, and it can only be a matter of a few years for the simpler uniform system to acquire a footing for all the purposes of private life.

The number of European time standards is stated by Dr. Busschere to have been twenty-four on Jan 1, 1891, and by the end of 1892 it will only be thirteen. Of these, three are meridianal standards, while ten are the times of capitals, viz: Paris, Madrid, Lisbon, Rome, Berne, Bucharest, Athens, Copenhagen, Berlin, and St. Petersburg, but the last as already mentioned, practically belongs to the former category. It now remains only for France, Spain, and Portugal to adopt Western European time, for Denmark, Switzerland, and Italy to accept Central time, and for Greece and Roumania to join the other Balkan States in using Central or Eastern time, and the change will be complete.

Strangely enough, although foreign writers tactly assume that the British Islands are at one in their time standard, there exists in the United Kingdom a diversity as illogical as that which formerly reigned in the

states of Southern Germany. While Great Britain and the Small island groups associated with it keep the time of the initial meridian, now extended to Belgium and Holland on the east, Ireland is regulated by Dublin time. Thus it happens that when the postoffice clocks at Stornoway (6° 15′ W.) shows noon that in Donaghadee (5° 30′ W.) only marks 11h. 35m.

As long ago as 1888 Japan adopted for its standard time that of the ninth hour interval from Greenwich (135° east) so that the clocks which regulate the movements of the Japanese are set nine hours in advance of ours.

India, Australia, and Cape Colony remain independent in their time relations, although so simple an adjustment as is required might form a graceful concession to the spirit of federation without sacrifice of local dignity or utility.

EXCAVATING IN FROZEN EARTH.

A NOVEL method of thawing frozen earth for making street excavations was described by Mr. H. H. Kelley, superintendent of the Waltham (Mass.) gasworks, in a paper read before the New England Association of Gas Engineers. Stone lime is spread several inches deep over the place where it is desired to excavate, and is thoroughly wetted and covered with straw. A piece of canvas or tarpaulin is spread over the heap, and is left for twelve hours, more or less. In two cases in which Mr. Kelley has tried this method recently, frost 18 inches to 26 inches was removed from the ground. In ordinary cases the expense of the lime would be too great to permit this plan to be adopted, but gas companies can use the lime afterward in their purifiers.

AN ENORMOUS AEROLITE.

AN aerolite of enormous size is reported by the newspapers to have fallen into the Caspian Sea, not far from Apsheron. As it now lies it has, it is said, the appearance of an ordinary rock projecting over twelve feet above the level of the sea, which at this point is twenty-five feet deep. Its fall was accompanied by a loud noise, and the sea was greatly perturbed for a considerable distance.

ABE HANSON, SCULPTOR.

THERE be stranger things in this world than the bed-fellows which politics makes, or even freaks of nature. Stranger than the phenomena of matter are the riddles of mind. Men are born into the world like beautiful patterns blurred, their symmetry and wholeness destroyed by nature's seeming carelessness or, to be broader, apparent loss of cunning. And yet the surgeon's knife has laid bare the error of nature and men can point to her uncompleted and ill-done work, telling what is lacking or what has been done without skill. But no chart or map of the mind has yet been made by which to square and measure human genius. The effect, the result is there, but not the cause. Only in a blind, confusing way can men point to some great gift, some inexplicable endowment, which has set its fortunate possessor many milestones in the lead of other men and has arbitrarily given powers which lifetimes of study cannot acquire.

Who can explain how an unlettered colored boy can with his hands, unaided save by a simple knife or pointed stick, carve from stone images of marvelous trueness to life, or fashion from clay forms of life whose accuracy is not merely mechanical, whose finish of execution and tastefulness of design betoken the true artist? Strange place to look for aught that tells of higher things than common existence—in the breast of this rude, unlettered lad, who goes by the name of Abe Hanson, of Kansas City.

Attention to Hanson's extraordinary gifts was first called in an article in the Kansas City *Journal.* In a person who had the benefit of long training and instruction, such work as Hanson does might not be considered remarkable, but it is extraordinary in the case of one who has had no instructor but himself, no training but his unaided striving after excellence, no model or pattern but the image within himself, the creation of an artistic imagination.

To the voice that bids him strive he lends an eager ear and follows, as best the light already given allows him, the lead of the dim, unshaped ideal that beckons him onward.

Unlike many gifted beyond their sphere or station, Hanson does not waste his talents or allow them to lie in disuse. He is ever striving to do better

and longs for assistance to elevate himself and to develop his unusual powers.

"If I could only get somebody to help me, to send me away where I can learn more," is his constant aspiration, and it is one which furnishes an excellent opportunity for the exercise of some very effective philanthropy.

Hanson is nearly twenty-four years of age. He was born in Leavenworth, Kan., and lived there till about eight years ago. When he was a small boy his mother died and he has supported himself by odd jobs, never learning any trade. He has three brothers and two sisters, all older than himself and all away from home, being scattered through the East and South. His father is an old soldier and is at present an inmate of the Soldiers' Home at Leavenworth.

About eight years ago Hanson came to Kansas City, and has since lived here, working at odd jobs in a number of places. He was last employed at the Blossom House. During all this time he has used all his spare time in carving and fashioning in clay the forms of human beings and animals. His imagination, however, is not confined to these subjects alone, as he also executes many allegorical figures with rare taste and skill.

His favorite subject is the dog, and as a natural consequence his carvings and modelings of this animal are his best pieces of work. He prefers to fashion in clay, for the chief reason that it is quicker and a mistake can be easily rectified, whereas, carving from stone, a single mistake would spoil the result of long and laborious effort.

After his design has been modeled out he fires the image in an oven whenever he can find anybody possessing one sufficient to do the work and with sufficient sympathy to allow him the privilege of using the oven. His best pieces are gilded, and many of them cannot be told from china and plaster-of-Paris images.

Hanson's methods are as simple as it is possible to conceive. His only instruments are a basin of water in which is a lump of clay of the consistency adapted to molding, and a stick flattened at one end. With these rude and unpromising implements he works out in the plastic clay the image that is in his soul. He says he sees the image in the clay or stone and simply cuts away the wrappings that hide it from the outer view.

This is the soul of art, and if the workmanship is not perfect, if the untaught hand wanders and makes miss-strokes, if the image carved and fashioned does not conform exactly to that of which it is intended to be a counterpart, it is because the gift is only halved and because to the power to design has not been added the complementing ability to execute.

Hanson first became aware of his unnatural gift when a child. He always had a "knack" at fashioning forms in clay, and his favorite pastime was to indulge his inborn taste. His ability to carve is an addition of later years. In this branch of his art his sole and invariable tool is an old knife. Out of a peculiar species of soft stone he carves forms which are more nearly perfect than his work in clay, for the reason that he is compelled to proceed with greater care.

Among his pieces displayed are a carved alligator, which is a very creditable piece of workmanship, and a carved dog, which is even better. A modeled dog is wonderfully true to life, and a recumbent child in clay, begun and finished in a day, is the best he has yet done. His subjects, of course, do not embrace a wide range, and none of them are fanciful. Birds and angels are mingled with his favorites, dogs, horses and sheep. In the windows where he has been working for several days past are displayed a number of his best pieces. Prominent is the bust of Maj. Warner. As might be expected, however, his attempts at portraiture are the least successful, for the first reason that it is the most difficult sort of work, and for the second and purely ethical reason that his models are abstractions, subjective and not objective. He sees the dog, or sheep, or what not in his mind's eye, and when he attempts to portray a certain and particular dog or sheep or horse, he descends to copying instead of working out his mental pattern.

It has been suggested that a number of philanthropic gentlemen make up a purse and send Hanson East where he can develope his talents, as he so earnestly and eagerly desires to do. It is possible that something may come of this after the world's fair, for exhibition at which Hanson will soon begin an elaborate design suggested by Mrs. Patti Moore, and entitled "The Lady of the Lake." The design will be that of a lady standing in a boat holding a paddle in one hand and a hunter's horn in the other.

Hanson is modest and gentlemanly, ever seeking to learn and very grateful for suggestions which will help him in his work. His is a case of great interest, and his powers capable of great possibilities.

A NOVEL FOUNDATION.

A VERY simple method of laying the foundations on a swampy location, which did not furnish a firm sub-soil, was employed by an American engineer for supporting a low wooden building to be used for storage of machinery. Casks were set in holes in the ground along the line of posts, and were filled to the depth of about one foot with iron turnings. The posts were set in casks, which were then filled with iron turnings compactly rammed in place. A solution of salt and water was then slowly poured over these turnings, which compactly solidified into a hard mass. The heat of the oxidation of the iron was so great that the posts smoked and were charred, the latter fact probably being the reason why they have not as yet exhibited any signs of decay, and in this respect the use of iron turnings furnishes an advantage over the use of concrete for cask foundations.—*The Great Divide.*

A MARRIAGE IN HIGH LIFE.

SIX carriages drove into Greenmount cemetery, Baltimore, the other morning at 10 o'clock. It was a bridal party. The choice of a graveyard for the performance of a marriage ceremony was due to the sentiment of the bride and her devotion to the memory of her parents, who, for two decades, have lain buried in Greenmount. The groom was Colonel Hendric von Stamp, of Washington, and the bride Miss Mildred Hammond, daughter of the late General Howard Hammond. The party proceeded to the Hammond burial lot, and there, the bride standing upon the grave of her mother, and the groom standing upon the grave of the bride's father with hands clasped, Rev. F. S. Steerger, pastor of the German Trinity church, pronounced them man and wife. The lot was handsomely decorated with flowers.

NEW DISCOVERY OF A RARE LIMESTONE.

THE discovery of a magnificent mine, or rather quarry, of Caen stone is reported from Cartersville, Ga. The mineral derives its name from the old Norman city of Caen, in the neighborhood of which it has been extracted for nearly a century. Hitherto it has been very scarce and very dear, as previous to the present find the Caen quarries were the only sources of supply known. When first taken from the earth Caen stone is quite soft, and it can be whittled with a pocket-knife into any shape. It can also be turned to any design in a lathe like a piece of wood. After exposure to the air, it becomes like flint. When polished this rare limestone presents a marble-like surface slightly variegated, and of a rich chocolate-brown color.

DRAWING FOR WORKMEN—I.*

EVERY workman, no matter to what branch of the building trade he may belong, looks forward to the time when his condition will be bettered; and this hope that is always shining within him, is one of the most beautiful provisions of nature, as it often sustains him under the most trying of circumstances and gives him renewed courage to battle with the difficulties and cross-purposes that beset the life of a young workman. It is well that the *hope* implanted within us sees only a bright and happy termination to all our struggles. Alas! how many of us would sink into the deepest abyss of despair if we only looked at things and accepted them as they appear?

But, this is not to our purpose. Hope, when allied to effort, seldom fails of bringing to their possessor a large meed of happiness and prosperity especially so if proper judgment is displayed in directing effort; and we confess we do not know of any better way that a young workman's efforts can be directed than by employing them in acquiring a thorough knowledge of everything that pertains to his trade, and to do this, one of the first requirements will be to become a draftsman, for a knowledge of this art, will enable him to fix in his mind a true conception of what really a good thorough workman ought to be, and if he is at all ambitious he will strive to attain the high position this conception demands, and which, when attained, will prove a source of pleasure and profit.

FIG. 1.

Taking these things into consideration we have thought it would add to the usefulness of this journal to give a few easy lessons from time to time, on drawing instruments, drafting, and ornamental drawing, and to this end we have made arrangements to publish a series of papers on these subjects.

A fine workman requires fine tools, and no man can do a fine piece of work not having the proper tools to do it with, so no man can do a good piece of drafting without having the necessary tools, therefore, it will not

*By Fred T. Hodgson, author of "The Steel Square and Its Uses," through the courtesy of *The Operative Builder* of New York.

be out of place to commence these papers with a description of the instruments required, and the manner of using them.

The first thing the young draftsman will require, will be a drawing-board. This may be made at home, but should be true on its face and the edges should be exactly at right-angles with each other, or perfectly *square*. The board may be made in size, to suit the requirements, but should never be less than 12 by 17 inches.

It may be clamped on the ends with stuff about 1¼ inches wide and the thickness of the board, or it may be held together with battons either screwed on to the underside as shown at Fig. 1, or dovetailed into the board across the grain as shown at Fig. 2. At Fig. 3 a much better board is shown and one we can recommend as possessing nearly all the qualities of a perfect board.

A glance at the illustration will explain the good qualities of this style of board. The wood used should be carefully selected pine, with hardwood cross bars at back. To prevent the warping of the pine, the board is sawed half way through at about every two inches, and for the purpose of allowing the board to contract and expand, the cross-bars are not glued on, but fastened with screws, which run in oblong metal slots. At the ends, pieces of hardwood are inlaid, to give the T square a smooth working edge. They are also cut at every few inches, to allow for contraction and expansion of the board.

FIG. 2.

While the cheapest boards are made of white pine, it doesn't necessarily follow that boards may not be made of other woods, cedar, mahogany and straight-grained walnut make very fine boards and answer very well where you do not require to use pins for securing the paper to the board. When thin pine-wood boards are used, it is as well to employ glue or mucilage in fastening the paper to the board.

The next thing required by the draftsman will be paper, and just here let us say, that the young beginner had better first use any kind of cheap paper to practice on, as the better class paper is rather expensive and is no better than common for experimental purposes—ordinary smooth-faced wrapping paper is just as good as any for the learner's purpose.

Drawing paper is made in various standard sizes as follows:

Demy	20x15 inches
Medium	22x17 "

Royal	24x17	inches.
Super-Royal	27x19	"
Imperial	30x22	"
Elephant	28x23	"
Columbia	34x23	"
Atlas	34x26	"
Double Elephant	40x27	"
Antiquarian	53x31	"
Emperor	68x48	"

Of these, Double Elephant is the most generally useful size of sheet. Demy and Imperial are the other useful sizes. Whatman's white paper is the quality usually employed for finished drawings; it will bear wetting and stretching without injury, and, when so treated, receives shading and coloring easily and freely. Common papers will answer for drawing where no damping or stretching is required. Large drawings that are frequently referred to, should be mounted on linen, previously damped with a free application of paste.

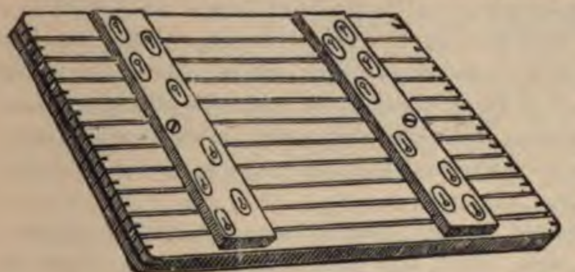


FIG. 3.

Drawing paper also comes in rolls of indefinite lengths, and from 36 to 54 inches wide. It is made different tints, is generally very tough, and is chiefly used for details; it is much cheaper than Whatman's, and for many purposes answers just as well. Tracing cloth, also, comes in rolls, 18, 30, 36 and 42 inches wide; it is convenient and durable, and may be folded up almost any number of times without injury.

Tracing paper is made of different qualities and sizes; it is rendered

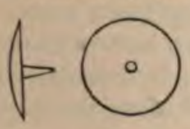


FIG. 4.

FIG. 5.

transparent, and qualified to receive ink lines and tinting without spreading. Like tracing cloth, when placed over a drawing already executed, the drawing is distinctly visible through the paper, and may be copied or traced directly by the ink instruments; thus an accurate copy may be made with great expedition. We cannot give reliable price quotations of these papers, as they vary somewhat, and may be different prices in different localities.

The paper should be fastened to the board with pins or thumb-tacks sim-

ilar to those exhibited at Fig. 4. These are made with a broad, flat head, of brass, white metal or silver, and rounded so as to permit the square to slide easily over it, and the stem should be of steel and riveted or screwed into the head.

At Fig. 5 we exhibit several styles of "thumb-tacks," all of which are well enough in their way, and we may add that there are a number of other styles of tacks of various kinds beside the ones shown.

When the young student gets down to "real work" and makes use of good paper, he should first damp the edges of the paper, then glue the edges and place fairly on the board, holding it in place with pins or other suitable appliances, which may be removed when the work is dry and ready to operate upon. This method of fastening is sufficient where no shading or coloring is to be applied, and if the sheet is not too long a time upon the board. It has the advantage, too, of preserving to the paper its natural quality of surface. With mounted paper, indeed, there is no other proper way of fastening. For large, colored, or elaborate drawings, however, a damp sheet is preferable; with coloring a flat tinting, indeed, damp stretching is indispensable, as the partial wetting of loose paper by water. causes the surface to buckle.

Damp-stretching is performed in the following manner: Lay the sheet on the board, with the face side under, and have the thick edges from the paper; draw a wet sponge freely and rapidly over the upper side, beginning at the center, damping the entire surface, and allow the sheet to rest for a few minutes till it be damped through, and the surface-water disappears. Those parts which appear to revive sooner than others should be retouched with the sponge. The damping should be done as lightly as possible, as the sponge always deprives the paper of more or less of its sizing. The sheet is now turned over and placed fair with the edges of the board—sufficiently clear of the working edges to permit the free use of the drawing-square. The square, or an ordinary straight-edge, is next applied to the paper, and set u little within one edge, which is then turned up over the edge and smeared with glue. The paper is then turned down and pressed on the board, after which it is rubbed down all along the "lap" with some smooth article. The same process is performed on the other edges of the paper. The whole is then left to dry, which, when completed, leaves the surface flat and tense.

[TO BE CONTINUED.]

PRINCE EDWARD ISLAND TUNNEL.

IT has long been proposed to construct a tunnel under the straits of Northumberland to Prince Edward Island with the main land of New Brunswick. The distance between Capes Traverse and Tormentine, the two proposed outlets, is eight miles, and the water varies from 60 to 160 ft. deep. The work of testing the rock is being carried on by the Electric Mining Company, of Ottawa. In order to accomplish the diamond drilling under the water a tripod of iron tubing is driven into the bottom, this giving a stationary surface, on which a platform is built beyond reach of the waves. The drilling is done through an iron casing sunk to the bottom. The test holes are a third of a mile apart and are carried 110 ft. deep.

TEST LOADS FOR BRIDGES.

THE *Centralblatt der Bauverwaltung* does not believe in the value of load tests for bridges. It considers that far too much importance is attached to it, and that, accordingly, erroneous deductions as to the safety of bridges tested by applying loads and noting the resulting deflections are abundant. The case is cited of an iron bridge in which a recent careful inspection revealed alarming local corrosion. Still, a test load, applied only a few days before, had produced a deflection well within permissible limits, and the railway company owning the bridge was therefore satisfied as to its safe condition.

UTILIZATION OF COAL SMOKE.

LUDWIG MOND, the brilliant Swiss chemist, has, it is said, not only discovered how to dispose of ordinary coal smoke, but how to turn it into a highly profitable commodity. The statement is that by burning 125 tons of coal, at a cost of $155, and making full use of it for steam raising purposes, he can at the same time secure, by a simple process he has invented, four tons of sulphate of ammonia from the smoke produced by the coal. The money value of this will be $240.

FOR ILLUMINATING A BATTLE-FIELD.

A YOUNG Italian has recently perfected an invention, under the direction of the Director General of Italian Artillery, which will prove of immense value in future warfare. It consists of a species of candle which

produces a most intense light. This candle is intended to be projected from a cannon and to strike in the enemy's works, or that part of the country where it is suspected they are. On striking any solid substance it breaks, and the substance contained in it, taking fire, produces a light estimated to be of the intensity of 100,000 candles which illuminates the field for a great distance.

EARACHE.

AT the first symptoms of earache, lie on the bed with the painful ear uppermost. Fold a thick towel and tuck it round the neck; then with a teaspoon fill the ear with warm water. Continue this for fifteen or twenty minutes. The water fills the orifice of the ear but overflows on the towel. Afterward turn your head, let the water run out, and plug the ear with warm glycerine on raw cotton. Do this for an hour or two and relief will be obtained. It is an invariable cure and will certainly prevent acute inflammation. Let the water be as warm as possible, but by no means scalding hot.

RESULT OF A SMALL NEGLECT.

IT is friction and not work that wears out a machine. It is, therefore, the object of every good mechanic to lessen the friction of every bearing surface, either by strict attention to the character of the bearing surfaces themselves, or by the application of carefully selected lubricators. Lubricators are used freely—too freely sometimes—on almost all machinery, but it is not always that the operators understand the nature of the lubricant that they employ, and consequently it often happens that they make anything but a wise selection.

CURE FOR SNAKE BITE.

THE April number of the *Therapeutic Gazette* contains reports of several cases of deadly snake bites which were cured by hypodermic injections of sirychine. It seem to be almost a sovereign remedy.

EDITORIAL COMMENT.

THE habit is growing with architects and builders to execute important stone carvings or sculptures in the wall after the front or building has been completed, rather than to have the parts cut in the piece and then fitted in place in the wall. We have not the data at hand of the relative cheapness of the two systems but it is unquestionable that the practice of cutting *in situ* presents every advantage of superiority in the even finish of the work and especially in the effect of toning the shadows, so that they will enhance the artistic effect from the point where it will be generally viewed. To an observer, looking at a piece of sculpture or upon a carved entablature, the high points will cast shadows in a different direction than they do when the workman is making the carving on the bench, in which situation he is looking upon his work from above instead of from beneath, and can only have a distant judgment of the effect he is producing, and if he does not invert the lights and entirely spoil the effect, he at least fails in those true touches that distinguish art from mere mechanics.

A FINE example of this may be seen in the Indiana Soldiers' and Sailors' Monument, where most of the carving up to the shaft is just now being executed. Granting that the sculptors are in both cases equal in ability, it is entirely unlikely that the four cougar-heads that form the corner pieces of the upper cornice would have had their startling fidelity and strength had they been executed on the ground instead of at the elevation of more than one hundred feet, where they were cut. That the design was both strong and artistic is now realized by the execution, and it is evident several squares distant, becoming more realistic as the complete detail comes out when one approaches proximity to the monument and looks at it from beneath. Both detail and effect would have been obscured or lost if the disposition of the shadows had been only slightly different, or if the high points had been left in a way to cast shadows over portions that should be visible to an observer from beneath.

AMERICANS as a people are gradually outgrowing the era of building where anything would do. Tawdry street fronts, careless foundations and unsafe walls, built only for the moment, and finished in still more tawdry paint and stucco decorations, are giving way to solidity of construction, rich and enduring materials, and attention to those minute details of design and execution without which the

art instinct cannot be realized. Stones that twenty years ago were used in the most pretentious buildings would now hardly be accepted for the commonest. Instead, the quarries of the earth are searched, and granites, marbles, jasper and onyx are lavishly used, and combined for all the wealth of color and tone they possess, both for the general effect of the whole structure and in the more specific art of interior decoration.

WE often have heard fears expressed by stone men, that the increasing use of iron and steel in construction, together with the use of brick in slow-burning construction would tend to injure the market for stone. But no such effect is either present or foreshadowed. Neither iron nor brick is capable of much expression, and neither possess the qualities of stone where massive and enduring structures are contemplated. The richer railroad companies are discarding iron bridges and constructing of stone exclusively. The maximum life of an iron bridge is about seventeen years, while there are many stone bridges now in daily use that were constructed twenty centuries ago. The life of iron or steel in a building will not be much greater than in a bridge. The deterioration of iron is not, as many suppose, due to rust so much as to the effect of strains and vibrations changing the fibrous quality of wrought-iron or steel into the crystalline condition of cast-iron. Its use in building will be more confined as the buildings increase in the character of massiveness and permanence. Some injury to the stone trade has resulted, but the efforts are local as well as transitory. Generally, there never was so great a demand for really good stone as at present.

THE stone trade has been greatly hurt by the large quantity offered that was of inferior quality. The public, like individuals, must get its knowledge through experience. There was a time, quite recent, when the buyer regarded any kind o stone as good enough stone, and often has been disappointed when his (to him) carefully prepared structure began to decay. But now the building public pretty well know the essentials for a good building stone, and have become very much more discriminating. While stone quarries are numerous enough, really good ones are comparatively rare. It may be that the structure of the stone itself renders it unfit, or it may be that while a quarry may be in a good formation, in so far as quality is concerned, the strata may be so faulty, or the quantity so limited that it is a losing venture commercially considered. Both causes have led to undue crowding of the market and a necessity to sell at any price. Often, again, the most inferior stones are those that may be most cheaply worked, and all these factors together affects the market value of all stone, especially among that large class of buyers who regard cheapness the first consideration. But as building grow in size and enduring qualities, poor material is entirely discarded, and a wider knowledge by the public of the nature of good building stone, is making it increasingly more difficult to market inferior stone for any except the commonest purposes. Unprofitable quarries will be abandoned and must be on the close margins current, but owners of really good stone in marketable quantity have nothing to fear from the future.

The great granite strike drags along, with many symptoms of weakening by the union. Gradually the quarry owners are getting other men, who, if they

begin unskilled, gradually become skillful. Meantime, many of the old men have scattered, and found other employment. and a sufficient number of the quarry-owners are out of the quarrymen's association to defeat its initial purpose. The strike (or lock-out) has resulted in the opening of new quarry lands where there was more than the market needed before, and it has resulted in bringing in many more workers, when there were more than could find employment before. It is all a pure destruction of mutual interests, and the results of it will be permanent. There will be more competition in the market by granite producers, especially as the idle quarries resume full operation, and for this and the ensuing season, at least, granite has been superseded in many buildings by other stone.

If the quarrymen finally succeed, as now it seems likely that they will, they will have the satisfaction of having had their own way, at an enormous expense, for perhaps three or four years, or until the non-union men gradually enter the old union or create a new one themselves. The old union men will learn by experience that there is a limit to the power of men, no matter how large their aggregate. They have had their own way so long, and have succeeded so often that they came to consider any complaint of theirs as pertaining in some way to the divine rights of mankind, and have lost sight of the inexorable laws that govern a trade, and that includes capital and labor as a single unit. Together they have wrought a degree of destruction that will take both a long time to repair.

"Labor" may take it as hard that opposition by employers should take the form of prohibition on a union. But a check of some kind to assumptions on the part of unions that seemed to have no end, left that as the only course. Conditions may be wrong, but employers are as much at the mercy of them as their men. The unions have got into a habit of looking at a sort of utopian society, until they have reached a conclusion that whatever emanates from them is perforce the only truth. Discipline has been lost sight of. An individual member of a union has in some way been injured or affronted, and the entire union is dragged into his individual controversy, and the most insignificant circumstance grows into a gigantic conspiracy. Organization is a unifer and is a good thing if its aims and actions are just, but equally bad if they be unjust. Organization is power, but power is as potent for evil as for good. But power, whether clothed in capitalist or laborer, begets arrogance, and tends to injustice. The powerful lose sight of the origin of their strength and become selfish and tyrannical, until it undoes itself by its own excesses.

In the case of the granite strike, the employers' complaint has been that the unions either could not or would not keep the contracts made with them, and that they would oppose obstruction at the most critical times. In many cases, at least, this is true, and the condition lies at the root of most of the trouble, not only in this case, but throughout the country and in every trade. The country is diseased to the core with this lack of keeping faith, and it pervades all classes. There is a specific instance of this afforded by a communication from the secretary, of a quarrymen's association, in reference to a case where one of its members quietly withdrew and made his peace with the union in spite of his promise to

the contrary. There have been rumors and whisperings that the whole lockout situation had been engineered by a few cunning men for some selfish purpose of their own. However this may be, there is too much of a struggle for an advantage of position, not to throw discredit upon some who have given currency to the suspicions. So prevalent is this habit that it has become unsafe to do business without a good lawyer to hunt out the loopholes and pitfalls left in a contract, and placed there by a good lawyer employed by the other party. The unions claim that employers (many of them) do not keep faith. The truth is that sharp practice has become too much the rule with all classes, who evade the moral obligations of their contracts whenever it is to their interest to do so.

THE general financial and commercial condition of the country is very promising and everything indicates that the season 1892-93 will be very prosperous, with the exception of the threatening labor war cloud that at this writing seems to be impending to draw all classes and trades into a suspension of industry through sympathy with the Homestead troubles. From its nature it cannot last long, but might prove very destructive, for there is no saying to what lengths a popular rising will go when once started; it is to be hoped, however that the apprehension is groundless. The wheat crop is assuredly great, and the market condition for corn, pork and live stock looks well ahead for the producers; money seems to be plenty and cheap, and with the exception of the really few by comparison, who are indulging in the summer luxury of a strike or lock-out, labor was never so generally employed, or so well paid.

THE most sickening incident that American history has thus far produced is the Homestead "affair." Not because of the blood spilt, because American ground has been well drenched, but because involved in the trouble was every sickening element of social evil that American institutions were built to prevent. It has no redeeming quality, no matter how viewed; as if both sides were experimenting how far the antithesis of the golden rule could be carried without reaching the depth of the bottomless pit. Greed, arrogance, and flippancy begun what fear, insolence and flippancy concluded. Both sides were wrong, and both have been multiplying wrong. The Carnegie company was arbitrary, and went beyond its moral responsibility in tactics that seem as if they were purposely designed to inflame their men. But the men were equally arrogant and their inflammatory action has placed them beyond the pale of law. One naturally sympathizes with the weak, but labor has so long asserted itself without material check from the employer, that it has come to view itself as incapable of either doing a wrong or of making mistakes, and has entirely lost sight of its true responsibility as a partner in industry. The price of iron is deplorably low, and the men affected by the new scale were perhaps the highest paid operatives in the United States. Perhaps some change was necessary, but no change was allowed to be discussed. Perhaps, also, the wages that had been current since the war, in the iron industry that has transformed so many millions into the pockets of the iron kings, had better been left alone. It certainly does seem inconsistent for employers who have been loudly insistent for advanced protection on their iron, to now proclaim that the only genesis of their position is to enforce free trade in labor.

THE average American, who has fallen into the habit of feeling proud of his country and its institutions, will feel humiliated at the spectacle presented by the House of Representatives in its hostile attitude toward the world's fair. What the perceptions of the average politician may be that he should seek a partisan advantage or display a partisan spirit of revenge in relation to an enterprise that in its magnitude, conception and execution will far suspass anything of its kind ever attempted in this world, where the power, the energy, the skill and the possibilities of this republican empire would be presented as the result of its peaceful conquest of this continent, such as they are, they disgust Americans who are proud of it all. There have been other times when the American people have proven stronger than the political destructionists who misrepresent public spirit in Congress, and they have now set out to have a world's fair, and they will have it in its original conception, with or without the concurrence of the "government."

ALL its features belong to baronial medievalism, when the lord in his castle and the banditti in the glen were at eternal war, until forces grew up that brought them both into submission to the law. The laws should be enforced, and indeed, must be, but the law is not equitable because it affords no refuge in the wrongs that may be inflicted by an owner of property, who, by owning the tools of the workman, has reduced him to a species of serfdom, only relieved by the extra-legal trades unions that against an abuse of power by capital, plants an abuse of power by labor. The spectacle of two hostile camps breaking into the peace of the country, and the law too imbecile to do more than proclaim the power of the all-powerful, is not a pretty one. Alien workmen gathered from elements foreign to the genius of America, controlled from a castle in an alien land by an alien-land-owner suggests that some new laws are essential if we do not gradually run into complete anarchy, or that completest of despotisms represented by a lawless and powerful oligrachy.

WE understand that the monument erected to the memory of the late Chief of Police Hennessy, illustrated in the July number of STONE, was made up in Maine and the work was all done by Italian stone-cutters. This ought to be a messenger of peace to the city of New Orleans and a guarantee against future race troubles.

SELECTED MISCELLANY.

TROUBLE AT HOLLEY QUARRIES.

A recent dispatch from Buffalo reads as follows: The labor trouble in the Holly Quarries, owned by Michael Stack are about settled. Taking advantage of what look like some important contracts, the stone-cutters demanded a 2-per-cent. raise in wages. This was refused and the strikers quit work. Several of the old men remained but claim that they were threatened with violence by the strikers if they did not join in the movement.

The dull stone market makes men more plenty than usual, and before the strikers knew what was up, neary all of their places were filled. There was a stampede and most of the strikers are now in their old positions, though there are some stubborn ones who remain out and threaten trouble.

THE CZAR AND KING CHRISTIAN'S CAT.

The *Morning* has got hold of an amusing story about the Czar. The sentries at the Palace of Amalienborg, at Copenhagen, were horrified a few mornings ago to see the Czar, in his shirt-sleeves and slippers, rush into the garden shouting and waving his arms about. All that had happened, however, was that the Czar, while dressing, had seen two of his dogs worrying a favorite black cat of King Christian's, and it was only to rescue pussy that the Czar had run out of the palace.

YOUNG WOMAN TURNING TO STONE.

Thomas Clemons, a farmer who has been living in Paul's Valley, Indian Territory, went to Kansas City to seek medical aid for Rose Lee Clemons, his 18-year

old daughter. The girl is slowly becoming ossified. She was born in Tulare county, California ; at birth weighed only one pound but was well formed.Since then her development has been slow. She is now four feet tall and weighs twenty-eight pounds. She has not a bit of flesh her skin being drawn closely over the boney frame-work of her body. She cannot talk because of a malformation of the tongue, but understands what is said to her and answers by signs. She has never been at all ill and eats heartily. Her head is well formed and she has bright brown eyes. Recently she was examined by Dr. Krueger and Dr. O'Neil who say that nothimg can be done to save her life.

STONE CORNICE CUTTER.

An ingenious instrument is used in Italy for the cutting of stone cornices, molding, balustrades, etc. The general features of the machine are very similar to those of the ordinary metal planing machine. The stone to be operated upon is firmly clamped on the bed, to which a reciprocating motion is imparted by suitable mechanism.

The cutting tools are carried on a saddle-plate capable of horizontal movement upon a slide by means of a screw and handle. The slide is, in turn capable of vertical adjustment on slide pillars by means of bevel gearing and screws.

The machine turns out sixteen feet of cornice, well finished, in twenty minutes.—*New York Telegram.*

NOTHING NEW UNDER THE SUN.

A two years' study at Gizeh has convinced Mr. Flinders Petrie that the Egyptian stone workers of 4,000 years ago had a surprising acquaintance with what have been considered modern tools. Among the many tools used by the pyramid builders were both solid and tubular drills, straight and circular saws. The drills, like those of to-day, were set with jewels (probably corundum, as the diamond was very scarce), and even lathe tools had such cutting edges. So remarkable was the quality of the tubular drills and the skill of the workmen that the cutting marks in hard granite gave no indication of the wear of the tool, while a cut of a tenth of an inch was made in the hardest rock at each revolution, and a hole through both the hardest and the softest material was bored perfectly smooth and uniform throughout. Of the material and method of making the tools nothing is known.—*News Record, Chicago.*

FLAGGING APPROPRIATE FOR KEELEY INSTITUTES.

In front of what is known as the Clark building in Peoria, says the *Herald*, the sidewalk is of stone. Each stone is very large and lies just as it was taken from the quarry. The surface of stone is largely composed of petrified rattlesnakes, some of them of mammoth size. The snakes are somewhat disfigured,

but they are still in the stone and plainly visible, even to the rattles. The quarry from whence these stones came ages ago was a great snake den. The snakes evidently crowded in between the rocks by thousands. But one winter the rocks, by some convulsion of nature, came together and the serpents were buried forever in the stone, and now their stony heads and tails are bruised by the heels of the sons and daughters of Eve every day right in the heart of Peoria.

A GRANITE DEALER THREATENED.

John L. Miller of the granite firm of Thomas & Miller, at South Quincy Mass. has received a threatening letter signed "Remember Frick," in which the writer referred to the fact that Mr. Miller was with the strikers thirteen years ago, but that he now was against them, and that when he was in sympathy with them he was one of the leaders and one of the most eagar to take summary vengeance on the manufacturers.

The writer further states: "You are now in a position where you can use your influence to have this matter settled if you were inclined to.

A keg of powder under your mansion would make a good tomb for you."

TRYING TO EXPLAIN A PHENOMENON.

Professors and scientists are trying to explain a rare physical phenomenon which occurred at Kern & Timme's stone quarry at South Kaukauna Wis., recently. Just as the men had quit work a rumbling' grating sound was heard, followed by a trembling of the earth, and the upper layer of rock which is two feet thick, cracked open for a distance of nearly 100 feet with a loud report and lifted up for a distance of nearly sixty feet on each side of the break. The force necessary to lift this area of rock is something enormous' The same thing occurred at the Combined Locks a couple of years since, nearly destroying the dam and paper mill, but it has never been explained.

FIGHTING AMONG THEMSELVES.

There is trouble between the two marble-cutters' unions of Chicago on account of the use of prison-cut stone. At a recent large mass meeting charges were preferred against the members of National Union, No 2, that they were using this stone, and a committee was appointed to wait upon the officers of the union and try and induce them to quit using such material. The committee which was appointed at the last meeting of the Trade and Labor Assembly to investigate the Pinkerton agency and if possible secure indictments againgt the officers, is ready to make their report.

The committee has found that the governor is invested by statute with dis-

cretionary power to grant or refuse license to such organizations. The committee will recommend that at the next meeting of the assembly the governor be requested by resolution to revoke the license granted to Pinkerton on the ground that he has violated the law in invading a state with an armed force.

STONE-CARVING AND ELECTRICITY.

Electricity has now been applied to stone carving—the blow having been struck by means of Carstarphen's electrical reciprocating tool. With this machine, the stone-cutter or the sculptor can devote his entire attention to the lines his instrument is to follow, while doing the work more rapidly than by his own muscular power.—*Boston Post.*

COLORADO RED SANDSTONE.

The market for Colorado building stone is still growing in the East. A contract for the shipment of 100 cars of red sandstone from Fort Collins to St. Louis via the Union pacific and Wabash was recently made. This stone is to be used in the erection of a fine building in St. Louis, which will of itself be a splendid advertisement of this Colorado product.

RAILWAYS IN INDIA.

The length of railway communications open to traffic in India in March last was 16,890 miles, at the same time the length under construction was 1,684 miles. The corresponding figures in March last are 17,375 and 2,160. Thus during the twelve months 485 miles have been opened, and an additional 960 miles have been taken in hand. The construction of railways in India was commenced in October, 1850, and the date of the first opening to traffic was August, 1855. So, since the commencement of operations, there has been an average addition to the open mileage of about 420 a year.

TOMBSTONES AT AUCTION.

"Now then, gentlemen, here's a fine substantial tombstone guaranteed to wear well and stand any excess of temperature. Worth $200 if it's worth a cent. What am I bid? $150? $100? $75? $50? $25? What, nobody give $25? Why, it would pay any gentleman to buy at that price and keep it for himself." Quotations for gravestones were low, however, yesterday morning, and nobody seemed anxious to buy. The occasion was the sale by the assignee of the stock of Van Gun-

den & Young's Granite and Marble Works at No. 1221 Spring Garden street, the firm having gone down in the Spring Garden Bank crash. In the yard were samples of some of the finest work and material in the city, but the prices were away off.

About a dozen dealers in headstones had been attracted by the announcement of the sale, but their hearts were evidently as hard as the granite in which they dealt, and, as everything had to go, they were plainly determined to get as good bargains as possible. Outside of the dealers about a dozen people were present, who came with the idea of getting stones for deceased relatives and friends at cut rates. The entire contents of the yards and shops, which originally cost the firm over $15,000, realized scarcely $1,500.

In spite of Auctioneer Ellis' eulogy of the $200 headstone, bidding was finally started at $5, and the stone was sold for $24. The first piece offered for sale was an elaborately carved angel on a massive rough cast pedestal, all of the finest Italian marble. Material and work cost $350, but the bidding started at $5, and William Davidson, a Wilmington dealer, secured the stone at $21.

F. Mooney was the first individual buyer who secured a bargain. He got a finely-carved Italian marble headstone, valued at $100 for $16, and will erect the same over the grave of his son. William Silence, a marble dealer, got the next, a $70 stone, for $7. John McCullough, who also bought for immediate use, got a fine American headstone on base for $5. He will put it on his wife's grave.

A monumental statue, emblematic of "Resurrection" and worth fully $300, was knocked down to a dealer named Sheehan for $37.50, while the same purchaser got "Hope," another fine statue, which had cost $175 in Italy, for $58. A boy statuette, worth $150, went for $19, and two pieces of pure statuary, worth $300 each, were knocked down to a Mr. Alberts for $34 and $35 respectively.

A colossal model of the Recording Angel, which Mr. Van Gunden said had cost $800 to model, was sold to Teddy McCaulley for $1, and then the purchaser was afraid he had a white elephant on his hands.

The highest price realized for any single stone was $110 for a handsome granite cross monument. A number of dealers entered a sharp contest for it and the price was quickly run up in $2.50 bids.

When it came to selling off the marble in the shop and rear yard the slaughter began in earnest. It was hard to get a bid of over a dollar, and fine lots of marble went for 25 and 50 cents. One man got six large blocks of statuary marble for $1.25. It was fully worth $50.

One of the most interested spectators of the sale, was old Mr. Van Gunden of the assigned firm.—*Philadelphia Record.*

"HUNTS" INNOCENT MARBLE DEALERS.

A traveling man by the name of Hunt was taken in custody by the sheriff last week says the *Herald* of Lancaster, Wis. for practicing fraud on a Montfort Marble dealer. It appears that he contracted with a lady in Boscoble to firnish her a $450 monument for $250. A contract was drawn up for purchash of the monument by Atty. Blanchard of Boscoble, who was careful to see that no grounds

for fraud was left open. Hunt, or some-one interested in the deal, chauged the duplicate contract, and Hunt soid it to the Montfort man for a commission of $50. Hunt will have his hearing before Justice Wheeler to-day.

FIVE MILLIONS FOR FOLLY.

More than five millions of dollars in wages are said to have been lost already in the granite strike in New England. The quarries remain intact, however, and the money is simply waiting to be taken out by the coming generations of the horny-handed sons of toil.—*Provideuce Journal.*

"OLD SOL" AS A QUARRYMAN.

A crack 75 feet long and nearly a foot wide was made in the rock in the quarry at Kaukauna, by the intense heat Sunday afternoon, says the Fond du lac (Wis.) *Reporter*. The report was lond, and some people thought it was an earthquake. It would have taken 25 pounds of dynamite and several hours' work to to do the same work. The same thing happened at the combined locks about a year ago.

BOOKS AND PERIODICALS.

"The Presumption of Sex" by Oscar Fay Adams, is a recent work from the press of Lee & Shepard, Boston, is the last, so far, of an interesting series by this author on the traits and foibles of the sexes having their rise in the egotism, and presumptive privilege, that are summed up in the several titles of his series, as "the Mannerless Sex," mainly pointing to such habits as women often show in street cars and other public places of accepting courtesies with that *grandoise* thankless air that often makes one ashamed of his galantry. Other titles—the "Ruthless Sex" and the "Brutal Sex," fairly divide the strictures, that are summed up in the present volume with the "presumption of sex," where a general comparison is made and the criticism evolved by his other works are answered. It is both interesting and caustic, and both sexes may improve by reading it. Its price is $1.

"Equatorial America" is a book by Martin M. Ballon, descriptive of the West Indies and South America, comprising the most noted features combined with a happy faculty for close observation, that give it special interest to that large and growing class who are looking with commercial eyes to this region recently opened to Americans by reciprocity. The style is sprightly, and there is no essence of the shop in it, while it is free from the stilted "guide-book" style common to many "books of travel." It is from the press of Houghton, Mifflin & Co., (the "Riverside Press") crown 8vo. in size and $1 50 in price.

"God's Image in Man" is, as its title indicates, a theological work, but not the scholastic theology of denominational speculations or dogmatic assertions based upon religious traditions, but an analysis of the intuitions of mankind in connection with his intellectual preceptions, In a certain sense it is a scientific deduction from that unconscious intuition that is as much a part of the phenomena of nature as the undulatory theory or speculations on the ether, or whatever it may be, or even if it be not at all, is necessary to explain phenomena. It is non-professional, and therefore independent, and the author, Henry Wood, has more or less unconsciously filled a want half expressed by the thinking, who are unsatisfied with the tendency of modern thought to a complete materialism, that in the most advanced science is as dependent upon what seems to be immaterial agency af the most distempered vision of orthodox theology. Articles by this author in four recent numbers of the *Arena* magazine have attracted wide attention and been highly commended. Lee & Shepard, Boston, are the publishers. Price in cloth, $r.

A valuable work for civil engineers, contractors and mill-builders, has been issued by John Wiley & Sons, in a "Text Book on Retaining Walls and Masonry Dams." The author is Mansfield Merriman, Professor of Civil Engineering in Lehigh University, well known as one of the most practical of technical teachers. Both principles and methods are given in great detail with numerous illustrations, with diagrams and formula explaining them, accompanied with numerous tables containing all useful reference of weights and coëfficients of materials. It is a book that no constructionist can afford to be without. The price in cloth is $2.

"Matter, Ether and Motion," is a work by E. A. Dolbear, Professor of Physics, Tuft's College on the factors and relations of physical science, Such a work has been urgently required by that great public that has only kept pace with the

advances in scientific knowledge through the medium of text books of the schools and the popular press, that deal mainly with overthrown hypotheses and a misleading nomenclature. This is not only true relative to hypotheses, but to the bearing of phenomena on facts that recent discoveries and mechanical applications demonstrate. The prodigious activity of modern popular thought relative to the practical applications of etheric or atomic motions popularly understood as electricity, magnetism or heat, demands a far more perfect conception of the laws that govern them. In this relation the book fills an important place, and should be read and followed up by every inventor and investigator, no matter what his field, because it touches the relations of all matter and all motion. It is a unifier and simplifier to the imagination, for it is with imagination only that the atomic relations can be followed, and it has been the imagination alone that has given birth to the steam engine, "dynamo," telephone, or phonograph. It is not a text book, and does not deal with formula, but phenomena, their actions and reactions. It is published be Lee & Shepard, Boston, and the price, in cloth, is $1.75.

An old friend in a new form is what may be termed the new edition of J. P Trowbrige's "Father Bright Hopes: An Old Clergyman's Vacation." It was one of the very first works of Mr. Trowbridge, and has been out of print for some time, but the demand for it led the author to revise it, and with new plates and illustrations will find many new readers among the young, and old, too, will gladly renew an old and valued acquaintance. The publishers of the new edition are Lee & Shepard, Boston. Price in cloth $1.25.

"The Knightly Soldier," is a biography, of Henry W. Camp, whose connection with the Eastern armies during the civil war does a signal service as a photographic view of these stirring events hot from the brain and true to the impulse of the moment; more vital than the host of memoir that has poured forth in the last ten years, where the recollections partake more of an air of mistiness that delineates rather than photographs. The biography was written in 1865, and was published by a firm that went out of existence years ago, and the book went out of print. It contains the experiences of early life. The military history begins with joining the Hartford Lightguard, in the summer of 1861, and continues from the advance on Roanoke and Newbern, through the first Charleston expedition, James Island, life in various rebel prisons, the campaigns on the James and before Petersburg, to the death of Major Camp just before the surrender at Appomattox. Old campaigners in the Eastern armies will hail the book as an opportunity for fighting battles over again. The biographer is Chaplain A. Clay Trumbull, a close friend of the hero. It is published by John L. Wattles, Philadelphia, and the price in cloth is $1.50. It is handsomely printed, with fine illustratious and contains 336 pages.

Outing, always interesting to lovers of healthful sport and pastime, is doubly so during the summer months. The July number is a particularly attractive one. The contents are: "A Plea for the House boat," by C. L. Norton; "From the German Ocean to the Black Sea," (illustrated) by Wenona Gilman, illustrated by Stull & Watson; "July Rides," by Jessie F. O'Donnell; "Trouting with a Camera," by "Multiplier;" "Cynthy's Joe," by Clara S. Ross; "Shot-putting," by Malcom W. Ford, illustrated; "The Ballast Fin," by A. J. Kenealy, illustrated; "Woodcock Shooting on the Upper Mississippi," by T. S. Van Dyke; "We Girls Awheel Through Germany," by "Martha," illustrated; "Pickerel-Fishing in South Jersey," by John Gifford, illustrated; "The Oar in the Northwest," by H. W. Wack, illustrated; "Harry's Career at Yale," (continued) by Jno. Seymour Wood; 'The St. Lawrence Skiff," by C. B. Vaux, illustrated; "The Military Schools of the United States," by Lieut. W. R. Hamilton, U. S. A., illustrated, and the urual editorials, poems, records, etc.

The *Atlantic Monthly* for July opens with a review of the military capacity of General McClellan, by Aben Grenough Scott. In the main it confirms the popular verdict of a great organizer and strategist, combined with slight tactical knowledge and indecision of character, but who has suffered unmerited obliquy. Edward S. Mason has an article on Chicago that is true in its grasp of the conditions that have made it and of the unity and energy that sustain it A well-written article on Arabian horses, by H. C. Merwin, will interest all who are devoted to the improvement of the genus *equs.* "Looking toward Salamis" is a review by William Cranston Lawton of the causes that led to the predominance of Athens in the affairs of Greece, and is both logical

and interesting. Theodore Roosevelt has a paper on "Political Assessments in the Coming Campaign," reciting instances and arguments that have not gained or lost since the civil service subject began. Talleyrand is reviewed anew, with graphic power in portraying that ubiquitous and many-sided character. Novels, poems and literary reviews complete the July issue.

There are probably not a few of our readers who have become interested in photography, either as a means of recreation or as an aid to business. To such as need the helpful influence of photographic publications, (and who does not) we would commend any of the following periodicals: *The Photographic Times*, an illustrated weekly journal published at New York by *The Photographic Times* Publishing Association and ably edited by the compiler of *The American Annual of Photography*, which has an extensive sale each issue; *The St. Louis and Canadian Photographer*, published monthly at St. Louis, Mo. by Mrs. Fitzgibbon-Clark. Subscription price $3.00 per year. A handsome publication of 90 pages well filled with practical and timely articles and embellished with beautiful process engravings and mounted photographic prints as well; *The Beacon*, a 60-page journal "devoted to photography in all its phases" published monthly by *The Beacon* Publishing Company, Chicago. A very conservative, reliable exponent of the art of photography, well edited and worth much more than the subscription price $1.50 per year.

Good Housekeeping for July opens the fifteenth volume of that admirable journal; and though a mid-summer number, its generous table of contents will be found as interesting, as valuable and as varied as ever. It deals not alone with the material interests of the household, but treats in its careful, thoughtful and thorough way every subject of interest, from the making of preserves and the management of the laundry, to the study of the servant question and the cultivation of that spirit of kindly helpfulness and consideration which gives to the home its vital spirit. There is no better or more welcome visitant in its sphere, and that a wide one, summer or winter, than *Good Housekeeping*. Clark W. Bryan & Co., publishers, Springfield, Mass.

MONUMENTAL NOTES.

An interesting archæological find has been reported from the neighborhood of Foster's Ferry, on the Warrior river, about nine miles south of Tuskaloosa Ala. When the recent high waters receded from the river bottoms it was found that the current had unearthed a prehistorical burying ground. Great quantities of human bones, rough stonework and pottery were left exposed. It is surmised here from the nature of the relics found that it was a Choctaw burial ground; but a thorough examination will be made at once and the results reported.

The citizens of Dubuque, Iowa are considering means to erect a statue to Julian Dubuque on the spot where his remains are buried. It would serve to perpetuate the memory of the first white man who set foot in what is now Dubuque, but also because the shaft, reared on a lofty bluff, will be visible from points in Wisconsin and Illinois and for miles up and down the river, and be a most attractive and suggestive ornament.

The Grand Army Post, at Dayton, Ohio, are talking of erecting a soldiers' monument in Woodlawn Cemetery.

The Fifteenth Wisconsin Volunteers in the late war, held a meeting at St. Paul, Minn., and recommended that the association become incorporated for the purpose of erecting a monument to the memory of this distinguished Scandinavian regiment in the city of Madison, Wis. A committee of nineteen will be appointed to carry out the plan and devise methods of raising a fund.

There is a movement on foot to erect a monument to the memory of John Plankinton, at Milwaukee, Wis. It has been put to the Plankinton heirs that if they will donate a triangular space bounded by Wells, West Water and Second avenue, that the $20,000 necessary will be forthcoming, which has been favorably received by the heirs.

The largest artificial stone in the world forms the base of the Bartholdi statue of liberty, on Bedloe island, New York City. This immense stone was made from broken strap rock, sand and American cement. Five hundred car-loads of sand and over 20,000 barrels of cement were used in manufacturing the monster.

The large stone which is to form a part of the architrave of the memorial arch at Concord, N. H., weighs 40 tons, and was cut from a granite rock which, when taken from the quarry, weighed 60 tons.

In the Topeka cemetery, buried in a circle near the soldiers' plot, are the graves of twenty-four of the soldiers killed in the Battle of the Blue near Kansas City, in 1864. These are the oldest soldiers' graves in the cemetery.

Norristown, the birthplace of Gen. Hancock, who is buried there, is preparing to erect a monument to their hero. The event is of more than local importance, as of all the generals of the civil war, Gen. Hancock was the most popular, if one considers his subordinate position under such chieftains as Grant, Sherman or Sheridan. The movement thus far is confined to Norristown, but efforts are being made to extend the subscription.

It is said that at the cemetery of Atchison, Kan., there is a monument telling what a tender, devoted husband lies under it, and how his wife longs to join him in the world beyond. The wife recently made her will, and

requested that she be not buried anywhere near her husband, as she hated him in life and will hate him in death.

The committee having in charge the erection of a monument on the battlefield of Chickamauga in memory of the soldiers of the Wilder brigade killed in battle, held a meeting in Indianapolis, recently. A number of designs were discussed, the one finally selected being after the style of Miles Standish monument at Plymouth, Mass. It will have a square base and round column with a spiral stairway upon the insides. The elevation will be 110 feet and near the top will be a steel balcony. The base will contain eight granite tablets, a place for the inscriptions of each regiment of the brigade participating in the battle. Upon the inside of the base a bronze safe for the reception of muster rolls and other valuable papers of the brigade will be built. The brigade wlll hold a reunion on the battlefield September 15 and 16, at which time the monument will be unveiled. It will cost $25,000.

Citizens of Lincoln, Neb., are talking of erecting a monument to John A. Anderson.

The citizens of Saginaw, Mich., are exerting themselves for a monument to Gen. Sherman, but it is not expected that the monument will be built at Saginaw, but the movement is in accord with a resolution passed at the annual meeting of the Army of the Potomac, held October 8, 1891. It is expected to erect it at Washington, and to make it in every way equal to the genius of the warrior it represents. The committee appointed at the Saginaw meeting are: F. J. Hecker, Detroit; D. H. Jerome, Saginaw; Edwin F. Uhl, Grand Rapids; Edwin C. Nichols, Battle Creek; Peter White, Marquette.

At a meeting recently, of the executive committee appointed by Camp Magruder, Galveston, Texas, to represent them in proposed entertainment for the Magruder monument fund, the following resolutions were adopted:

WHEREAS, the building of a monument to the memory of General Magruder is a cause in which all citizens should feel interested, particularly the Veteran Marines' Association, of Galveston, therefore be it

Resolved, that we extend to the above named organization a special invitation to co-operate with us in the enterprise now on foot to raise funds for the erection of a Magruder monument.

MISSOURI VALLEY ASSOCIATION.

THE semi-annual meeting of the Missouri Valley Cut-Stone Contractors' and Quarrymen's Association convened at the Sherman House, Chicago, on July 19.

Meeting was called to order at 2 p. m., by the president, C. A. Pfeiffer, with secretary W. E. Emery taking the minutes.

The president made a short address in which he deprecated mid-summer meetings of the association, as it was impossible to bring the members out at such a time unless there was business of urgent importance to transact.

The roll call showed just a quorum present.

Secretary read minutes of previous meeting, which on motion were approved as read.

This being a semi-annual meeting the reports of officers and committees were not called for. The payment of dues, however, was declared in order, and met with prompt response.

Mr Malone, in behalf of Chicago members of the association, extended an invitation to members present to visit the World's Fair grounds the following morning, which invitation was accepted with thanks.

It was voted to hold the next regular meeting in Omaha on the first Tuesday in March 1893.

The application of Prentice Brownstone Co., of Ashland, Wis., was presented, and applicant elected member. On motion meeting adjourned.

Tuesday evening the visitors were entertained by Mr. Bodenschatz with a visit to Lincoln Park to witness the display of the magnificent electric fountain.

The visit to the World's Fair was greatly enjoyed.

Omaha's representative, Mr. Scholl, promised the members a fine entertainment on their visit to that progressive city in March next.

THE FAMOUS CONNECTICUT BROWNSTONE REGION.

To THE EDITOR—*Sir*: The thought struck me that you might be interested in the history and present condition of the Portland Brownstone quarries and I herewith send you what literature we have at hand on the subject, and if it is any benefit to you or STONE, you are at liberty to use it.

You will find in *Lippincott's Magazine* for November, 1874, pages 529 to 542, an interesting history of these quarries up to that period. In the book *Building Stone*, gotten out by the Connecticut Steam Brownstone Co., you will find some views of the quarries taken last winter. These views would be much more interesting if taken during the quarry season, April 1 to Dec. 1, as at the time they were taken no work of any moment was in progress.

Since the publication of the *Lippincott* article (18 years) a constant change has been undergoing and railroads, steam channelers, travelers, derricks etc., have and are taking the place of the old methods of team work and means of producing stone that prevailed at that time.

The Portland quarries are keeping pace with the modern methods of operation, and although the oldest quarries in the United States they are still practically inexhaustible and are at the present time producing much more stone than ever.

We also send you a price list for Portland brownstone delivered at Philadelphia in the

Facia, 8 to 12 inches wide, 4 to 6 inches thick, under 6 feet long, per foot lineal	.26
Water tables, 8 inches square " "	.28
Facia and water table, 6 to 8 feet long, "	.35
Ashler, 4 to 6 inches thick, promiscuous sizes, under 24 inches wide, and under 6 feet long, per super. foot	.38
" " widths or lengths to order " " "	.43
" " 6 feet long and over " " "	.46
Window stuff and dimension flagging, per superficial foot	.33
Flagging "	.19
Cellar steps, 12 inches wide, 9 inches thick, per lineal foot	.38
Posts, blocks, lintels, etc., under 32 feet, per cubic foot	.76
" " " 32 to 50 "	.87
" " " 50 to 60 "	.92
" " " 60 to 100 " in same ratio	
" " " 100 and over to be agreed	
Posts, pilasters, lintels, architraves, etc., 10 to 12 inches square, per lineal foot	.76
" " " " 6 to 8 feet long, 8 to 10 inches square, per lineal foot	.52
" " " " 8 to 10 feet loug, " " "	.63
Steps 14 to 18 inches wide, under 7 feet long, per lineal foot	.57
" " 7 to 8 feet long, "	.66
" " 8 to 10 " "	.76
" " 10 feet and over in proportion to last grade.	
Platforms and wide door sills, 8 inches thick, under 18 feet, per superficial foot	.57
" " 18 to 24 "	.66
" " 24 to 32 "	.76
" " 32 and over in proportion to last grade.	
Door sills 16 to 24 inches wide under 7 long, 8 inches thick, one edge, per superficial foot	.46

Freight payable on delivery of stone. Balance in approved indorsed notes, at 60 and 90 days, discount of 3 per cent. for cash.

year 1854. This price list having been published years before any stone saw mill, planers

ubbing beds etc. had been introduced, does not quote prices on block stone. All stone at that time was quarried to dimensions, to fit the places in the building where it was needed.

There are many other interesting things about the Portland quarries which a personal visit here can only show in their proper light. We would be glad to show you about at any time if you could make it convenient to visit us, and in the meantime if our efforts to assist you in keeping up the quarrymen's interest in STONE have been of service to you or a benefit to the trade in general, we are amply paid for this humble effort.

You deserve a great deal of credit for the able manner in which you have placed STONE before the people interested in the stone business and you should have the support and assistance of all in or out of the trade.

Yours truly, FRED'K DE PEYSTER.

Portland, Conn., July 23.

[The artist-editor of STONE will soon visit the Connecticut brownstone section, and as rapidly as possible every other section of the country, and write up and illustrate everything of note.—Ed. STONE.]

THIS OUGHT TO COUNT FOR NEW SUBSCRIBERS.

TO THE EDITOR—*Sir:* I am in receipt of your courteous favor of the 9th inst. to the E. T. Stone & Marble Co. and the Rosebud Marble Co. Being president of both companies, I take pleasure in saying that I have been a constant and deeply interested reader of STONE for the past three years, and would not be without it. The stone trade of the United States is to be congratulated upon having such an able exponent of its interests, as they have in STONE. There is no trade publication in the country, that has improved so much or kept so thoroughly awake to the wants and requirements of the trade, as STONE. It is a sound, practical concern, and a growing power in the country. With sincere wishes for your continued success,

I am truly yours, J. E. HART, Pres't.

Knoxville Tenn., August 12.

LEGAL NEWS AND NOTES.

[Prepared for STONE, by V. H. Lockwood, Indianapolis.

TOMBSTONE LIENS.—In a New York state paper recently the following statement appeared: "Manufacturer of ordinary monuments in the United States have a right to remove their handiwork from graves in the event of its not being paid for within six months."

The source of information of the writer of this statement is not known, and it is believed that it mis-states the law. The books do not show any authority for such a position under the common law which exists throughout the United States, and if there be any law relating to it, it must be statutory, and therefore, it is not thought any law relating to it exists in a great many states, outside of common law. The common law gives the seller of a tombstone the same kind of lien as the seller of any other kind of chattel. He has a seller's lien as long as the tombstone is in his possession, and he has the right after it has left his possession to stop it *in transitu* before it passes into the possession of the purchaser. Hence, after a tombstone is set up, there is no lien except under some statute of the state. The seller could not trespass upon another's land, or remove personal property from another's possession without the aid of statute. It is rumored every now and then that there is such a principle of law applying to the taking of tombstones, but is believed that there is no foundation in the books for such a statement. There are reasons, too, why such should not be the law. It would be contrary to public policy to give to sellers an unregulated right which they could greatly abuse.

It is believed that the above is an ambiguous statement of the law in New York, which is statutory. The New York statute provides for a lien in such cases. At any time within a year after a tombstone is set up, the seller can file with the superintendent of the cemetery a notice that he claims a lien on such tombstone for all or a part of the purchase price. If, then, the balance due is not paid within six months after such notice is filed, the seller may within sixty days thereafter, having in the meantime given the superintendent of the cemetery ten days' notice, remove the tombstone outside the cemetery. Then he must give notice in two county newspapers that such stone will be sold at auction on a certain day, ten to fifteen days thereafter. After paying the expense of selling and the balance due the seller, the remainder is turned over to the purchaser. The provisions of this act show the necessity of such regulation when such a lien is exercised, and it shows also the danger that would result from such a provision as stated above at common law. Hence, it can be claimed that whatever difference there may be between liens in cases of monuments and other chattel property, depends upon the statute of the state, and only a few of them have any such statute.

STREET GRADES.—In Edward Yanish v. City of St. Paul, it was held that a city council, having general authority to establish streets, may, under peculiar circumstances, fix the grade for one side of a street on a materially different level or plane from that of the other side; and if this render it incidentally necessary to construct a retaining wall along the center of the street to support the earth on the higher grade, that may be done. Such an exercise of public rights is not an infringement of the rights of an adjacent proprietor whose property may be injured thereby.

If a city has power given by the legislature to grade streets, the common council or governing body has full discretion as to the exercise of the power. So it is held that the courts will not inquire into the necessity of the grading, or the refusal to grade, or whether a particular grade adopted, or a particular mode of executing the grade, is judicious. Possibly a plain case of abuse of any such power to the injury of a petitioner might under certain circumstances warrant an injunction, but the pre-

sumption is against such petitioner. Such functions are in their nature legislative. Hence the grade can be altered at will.

The power to grade streets is usually conferred on cities expressly, but if that be not so, it is usually implied in other grants of power. In Pennsylvania it is held that a city has an implied power to grade its streets when it is not expressly granted such power. The power to pave streets includes grading and all other things preliminary and incidental to good paving.

"Paving," as applied to streets, means in law their "reduction to a certain degree of ascent or descent."

A municipal corporation is not liable for damages resulting from the establishment or alteration of the grade of a street, unless the state law happens to establish such liability. It is not liable for any peculiar kind or method of grading, except as stated. There are several states, however, wherein abutting owners are compensated for injury from the change of grade of a street. If a statute fixes the grade of streets at their intersection, the streets between the crossings must conform to that grade.

In grading, shade trees may be removed if necessary, and the owner cannot get damages unless he shows negligence in the work. No liability exists independent of statute, if by grading the street a portion of the adjoining lot falls into the highway; or, on the other hand, the street is so cut down as to make the abutting lot difficult of access. This is true also when the abutting owner erected buildings or made improvements with reference to an established grade which was subsequently altered to the injury of such owner. But the city is liable if it obstruct streets by the approach to a bridge in a street, whereby the abutting owner's access is prevented, or water caused to flow and drain on his property.

Although many states have provisions relating to these topics, I might add that such injury from grading is not considered to come under the constitutional provision forbidding the taking of private property for public use without compensation. The property injured is not "taken," but merely suffers a consequential injury.

THE LIABILITY OF MANUFACTURERS FOR PERSONAL INJURIES TO THIRD PARTIES FROM DEFECTS IN MACHINES MANUFACTURED.—Heizer v. Kingsland & Douglas Manufacturing Company, is a recent case in the supreme court of Missouri which involves the above question. Kingsland & Douglas Manufacturing Company sold to one Ellis a thresher containing a defective cylinder; Heizer, a stranger to the contract of sale, began feeding the machine, when the cylinder blew out and killed him. The court held that the defendants were not liable for his injury, because they owed him no duty. They owed no duty to him by reason of the contract of sale, because he was not a party to it. The only other ground by which the defendants could be held liable is that the law casts upon some persons, such as common carriers or manufacturers or vendors of dangerous goods, a duty to all persons of using due care.

In the absence of a knowledge of the defect in the machine manufactureed, the manufacturer is not liable if an injury arises from such defect to one with whom he has no privity of contract, unless the article manufactured be dangerous, like poisonous drugs or explosive oils.

There is no doubt of the defendant's negligence in constructing the machine, but if liable to a stranger for an injury resulting from such defect, it would throw upon manufacturers of machines not necessarily dangerous a liability which the law does not justify.

CARRIER OF GOODS—LIMITING LIABILITY.—In the case of McCarn v. International & G. N. R. Co., the supreme court of Texas reviewed the authorities upon the question as to whether a common carrier may stipulate in a contract of shipment to a point beyond its line that it shall be released from liability after the goods have left its road. Upon the authorities i was held that in such a case the carrier may by contract protect itself against liability for loss not occurring on its own line, whether the shipment be wholly within the state or be interstate. There are some cases, however, which hold the contrary, and as to these the court says: "Can an obligation, based alone on contract, arise in the face of an express agreement that it shall not exist? That is the question involved in this and like cases, and in our opinion there can be but one answer. No court will assert that a common carrier is under obligation to carry, or to contract to carry beyond its own line. If, then, such common carrier agrees to deliver the goods to another line, but stipulates that it shall not be liable for injury to the goods on such other line,

there can be but one construction put upon such a contract without violating every recognized canon of construction applicable to snch a matter, and denying effect to the clearly expressed intention of the parties."

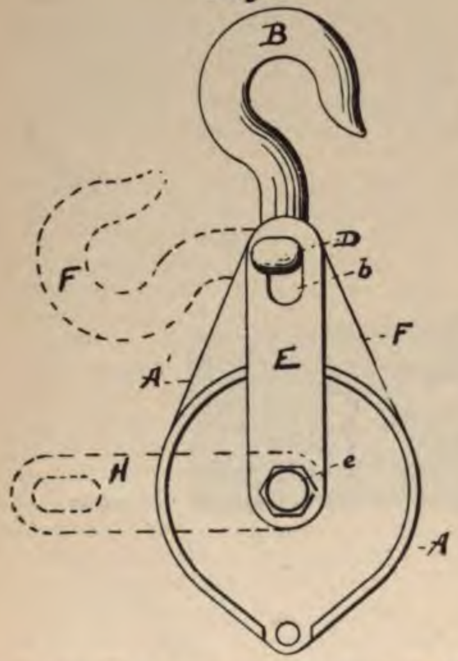
MASTER AND SERVANT.—In a contract for "satisfactory services," in Bush v. Koll, the court of appeals of Colorado decided that where a written contract of employment for a year at stated wages, required the servant to "render good and satisfactory service," the employer has the sole right to determine the character of such service, and his testimony that he was not satisfied settles the case as against evidence that he ought to have been satisfied.

BREACH OF CONTRACT BY RAILROAD TO FURNISH INSPECTED CARS.—A recent decision in Indiana may be of interest to quarrymen, although the law does not relate peculiarly to them. The Hoosier Stoue Company brought suit against the L., N. A. & C. railroad for damages for breach of contract to furnish strong and inspected cars for the transportation of stone. The complaint alleged that a car was delivered which the railroad inspector had failed to inspect; that the car was defective, and the defects were hidden and unknown to the quarry company, but would have been discovered on proper inspection by the railroad company. Because of the defect in the car it broke loose and, without the fault of the quarry company, ran down a grade and killed a quarryman. Of course it was held that under the circumstances of the case the facts were sufficient to show inexcusable breach of duty by the railroad.

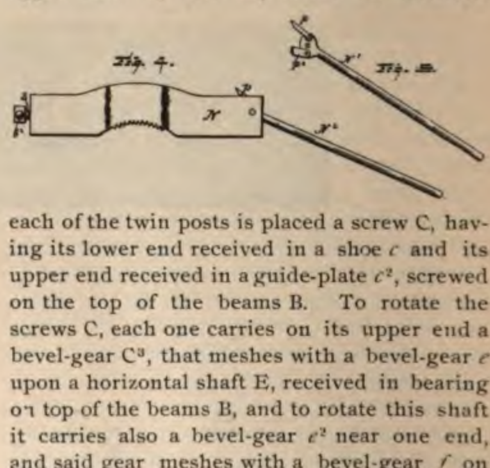
RECENT PATENTS.

No 471,755 is the invention of Andrew Wren of Seattle, Wash., and relates to that class of snatch-blocks which have one side partly open for the ready insertion or removal of the rope. In the drawings, Figure 1 is a side view of the block. Fig. 2 is an edge view of the same. It will be seen that when the block is closed, as in Fig. 1, in order to open it to insert or withdraw a rope it is only necessary to drop the hook B to the position shown by the dotted lines at F. This brings the lug D in line with the slot b in the strap E, and allows said strap to pass outward, so as to clear the lug (see dotted lines at a, Fig. 2) and to swing to one side, as shown by the dotted lines at H in Fig. 1. The rope can then be passed through the opening O. The block is securely closed by bringing the strap E to its former upright position, passing it over the lug D, and swinging the hook B into line with the block. The strap E is then held securely by the lug D, as shown in Fig. 1.

Fig. 1.

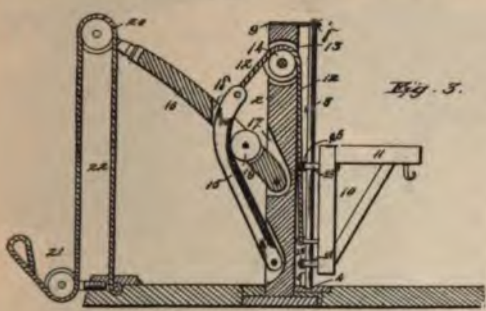


No. 471,331 is the invention of Walker Arnold, of St. Cloud, Minn. and relates to stationary rock-drilling machines, in which the quarry-bar carrying the drill-holder is pivoted at both ends in vertically-adjustable nuts; and the objects of his improvement are to provide a simple and reliable means for retaining the quarry-bar locked to the frame of the machine, and simple means, also, to advance the drill-holder and clamp it to the quarry-bar locked to the frame of the machine, and simple means also, to advance the drill-holder and clamp it to the quarry-bar. A represents the twin posts of the frame, connected together at their upper ends by the top beams B. Between



each of the twin posts is placed a screw C, having its lower end received in a shoe c and its upper end received in a guide-plate c^2, screwed on the top of the beams B. To rotate the screws C, each one carries on its upper end a bevel-gear C^3, that meshes with a bevel-gear e upon a horizontal shaft E, received in bearing on top of the beams B, and to rotate this shaft it carries also a bevel-gear e^2 near one end, and said gear meshes with a bevel-gear f on the upper end of a vertical shaft F. On the lower end of said shaft there is a bevel-gear f^2, that meshes with a bevel-gear g upon a horizontal counter-shaft G, that carries also a crank g^{u}, by which it can be rotated.

No. 471,898 is an improvement in Hoisting Cranes, invented by John O. Richmond, of Hart, Oceana county, Mich., consisting of a device more especially applicable to cranes and derricks of various construction; 1 is the base, which is preferably formed by two sections of heavy timber crossing each other at right angles near their middle and secured firmly in position at that point. Upon the center of the base thus formed is erected the standard 2, which is effectively anchored in said base and adapted to hold other parts, hereinafter referred to, in their operative positions. Near said standard is erected the pivoted jib 3, which may be formed of wood or other preferred material, the lower end being provided with a central end bearing point 4, which fits loosely in the socket 5, formed in a metal base-plate 6, embedded in the upper surface of the base near the foot of the standard 2. The upper end of the pivoted jib is provided with an annular



groove 7, adapted to be encircled by an aperture 8, provided in the horizontal arm 9, said arm being affixed to the upper end of the standard 2, as shown. This construction will permit the jib to rotate, carrying with it the triangular or usual form of crane or lifting arm 10, which is secured to said jib in such a manner that it may swing and slide thereon. The outer end of the crane-arm 11 is provided in the usual manner with a pulley block or hook adapted to form connection with the weight lifted, while that side of arm lying adjacent to the jib is provided with an outwardly-reaching arm or collar extension, to which is secured one end of the rope 12.

The other end of said rope is then extended upward and reaches through the slotted opening 13, within which is mounted the pulley 14. After passing through the slotted opening above and in contact with the pulley just referred to said rope is attached to the upper end of the lifting-arm 15, the lower end of said arm being pivotally connected to the lower end of the standard 2. The lifting-lever proper 16 is pivoted in a slotted opening 17, provided in that side of the standard 2 opposite the crane, and reaches outward horizontally therefrom, and is provided with the vertical opening 18, within which is loosely placed the pulley-wheel 19. It will be seen that the slotted opening 18 in said lever is sufficiently extended on the outer side of the pulley to permit the reception of the arm 15, the function of the lever being to bear against the inner face of said arm and depress the same with a minimum of friction. To the free end of the lever 16 is secured the pulley 20, which, in conjunction with pulley 21, fully controls the downward movement of the lever 16, as will be more clearly understood by reference to the drawings.

The combination of the several parts just described is such that a working machine will lift in the ratio of one hundred pounds for every five pounds applied on the end of the rope 22 The crane or arm 10 is constructed and braced in the usual manner, and when the several parts are assembled in the manner herein described the operation and advantages of the same will it is thought, be readily apparent, and further description is deemed unnecessary.

PUBLISHER'S ANNOUNCEMENTS.

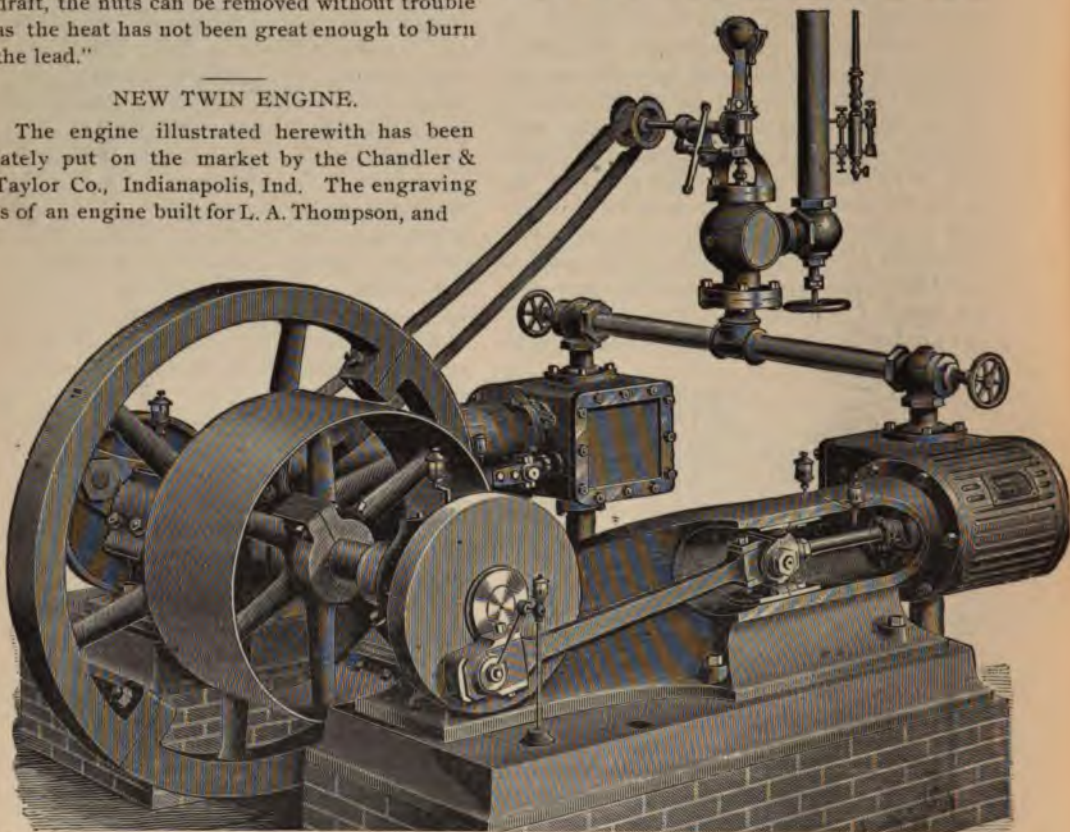
OTHER USES FOR GRAPHITE.

A correspondent says: "I have read an article on graphite taken from the *American Machinist*. Let me say that I have used graphite for many purposes, some that the correspondent did not name, which I will give as it may benefit some of my brother engineers, who perhaps have not experimented to any great extent with the article. I have used handhole and manhole gaskets eight to ten times by carefully smearing the surface next boiler shell, taken out at periods of three to four weeks, using steam pressure as high as 100 pounds. In packing water glasses, by putting a little graphite and oil on the gasket they would volcanize as soft as lamp-wick and retain their elasticity until the glass was changed, when the old rubber could be removed without trouble, while by the old way, I have spent much time

in digging out the rubber, baked hard as vulcanite. Another thing I used it for was after putting back my handhole plate or plugs in back connection, I carefully brush away all the soot and ashes, then with a small brush paint a good coat of graphite over flange, stud and nuts. After running boiler from three to six months, and using coke for fuel, with forced draft, the nuts can be removed without trouble as the heat has not been great enough to burn the lead."

NEW TWIN ENGINE.

The engine illustrated herewith has been lately put on the market by the Chandler & Taylor Co., Indianapolis, Ind. The engraving is of an engine built for L. A. Thompson, and



to be used on the switch-back railroad to be operated in Jackson Park, Chicago, during the continuance of the world's fair.

The arrangement consists of two engines, a right and a left hand, coupled quartering with crank disks on the ends of shafts, dispensing with outboard pillow-blocks. As is well known, only a moderate sized fly-wheel is required for this type of engine, and for many uses, as where great regularity is not required, this may be dispensed with, the turning will still be uniform for the required purpose. The working strains are also more equally distributed than with a sing e cylinder engine.

This engine it is claimed is so constructed as to admit of high rotative speed when desired, as in electric light plants and other purposes.

To render unnecessary the removal of crank disks (which are both permanently fixed) the band-wheels and eccentrics are made in halves; this saves work, and avoids the possibility of throwing out a crank in the operation of removing and replacing a disk.

The governor is placed at the center of the connecting pipe, and there are valves for shutting off either engine without affecting the other. When desired, these engines are fitted with link motion.

The R. C. Bowers Granite Co, Montpelier, Vt, do not seem to be materially affected by the strike as witness the following communication: "Our trade is about as heavy as it has been heretofore, and considering the strike we are getting work off with reasonable promptness. Under the circumstances we consider trade good."

Davidson & Sons, marble dealers and manufacturers of Chicago, report business fairly good both in the monumental line and interior decorations. At the present time they have in course of construction the interior marble work of the Mill's building at San Francisco, the

CHAS. A. PFEIFFER.

President Missouri Valley Cut-Stone Contractors' and Quarrymen's Association.

STONE

VOLUME V. SEPTEMBER, 1892. NUMBER IV.

THE BUILDING-STONE INDUSTRY OF THE UNITED STATES—III.

AS to the future of the stone industry, there can be no question. The possibilities which the various kinds offer in the way of architectural display, cannot be equaled by any other class of materials, natural or artificial. That Americans as a whole are rapidly learning to appreciate architectural merit must be apparent to any one that has observed the wonderful improvement which has taken place during the last dozen or twenty years particularly in the construction of business blocks and private dwellings. Given, then, a gradual increase in artistic taste and increased means for the indulgence in such a taste on the part of a large portion of the people, and neither architect nor contractor can have much cause for complaint. In quality and variety of materials we have as yet, however, much to desire. The Swedish, Scotch and English granites; German, French, Italian and African marbles are not imported because our people fail to appreciate the home product or because the foreign stones are cheaper. It is simply because they supply new varieties in texture and color, and because they are in some cases undeniably better. This last is especially true regarding many of the marbles. America does not as yet produce a stone with the close, enamel-like surface so desirable in marbles, and with a color and susceptibility to high polish equal to that of many foreign stones that might be mentioned. To this fact the writer has previously called attention in the pages of this magazine. To say that we do not produce them does not, however, necessarily imply that we may not do so at some time. Already systematic exploration—*prospecting*, to use a miner's term, is being carried

on in many localities, and while it seems pretty conclusively demonstrated that the highest grades are not to be found in the Appalachian regions, we have as yet the "boundless West" to draw upon. In the writer's opinion the marbles which are destined to exceed all other of our native products will yet be found in the arid and semi-torrid region south of Colorado and west of the Mississippi. Indeed, in addition to the newly-discovered "onyx" marbles of Arizona, the writer was but a few weeks ago shown samples from this region which gave great promise of equaling the Italian Siena and the wonderful products of Algeria.

While, however, we may yet go to these distant points for our higher grades of decorative stone, the demands of that large proportion of the most wealthy and artistic of our people will always be found upon our seaboard, or within easy access of tidewater, must be met with cheaper material for general building, and from sources nearer at hand. Weight of material and consequent cost of handling and transhipment always has and always must be an important item in this consideration. While, therefore, new sources of supply are continually being found, the older regions need not necessarily suffer abandonment.

By reference to the map in July STONE it will be seen that the Appalachian chain, the axis of disturbance that made available so great a variety of rocks in the East, gradually leaves the coast as it extends southwestward, and that south of New York it is but rarely accessible by tidewater. Add to this the fact above noted, that glaciation has carried away in the Northern states the ancient cap of debris, leaving the firm rock, the very foundations of old mountain ranges, exposed clear to the water's edge, and we see at once the immense advantage given by nature to this region.

In the early days of the stone industry, the opening of a quarry was dependent nearly altogether upon the local demand for stone of some kind, and that stone was taken which, owing to its position, was most readily quarried and transported, regardless of what the stone actually was. It thus happened that the first stone to come into general use in the Eastern United State were the granites of Quincy, Mass., and the brown sandstones of the Connecticut Valley. Undoubtedly the first real boom given to the granite industry was furnished by the demand for material for the Bunker Hill Monument, and which led to the development of quarries from other than bowlders, at Quincy. The Connecticut brownstones, quite independent of their desirable colors and excellent working qualities, in like manner owed their early prominence to the ready means of transportation offered by the Connecticut river, whereby access at slight expense was had to all the leading cities of the Atlantic states. The quarries on the Maine coast always have and always will have at least this one advantage over others of perhaps equally good material more remote from

KING'S CHAPEL, BOSTON.—BUILT OF QUINCY GRANITE IN 1749-51.
One of the First Stone Buildings Erected in Boston.

AMES BUILDING, BOSTON—BUFF AMHERST.

water highways. Once developed, it is but natural that such a quarry, if furnishing material at all desirable, should gradually extend its market, and for a time so monopolize the field even at a distance as to crowd out equally good or even better material close at hand. It was this fact coupled with the natural energy of quarry owners, that led to the use of Quincy granite in all the cities of the Atlantic border, and even far inland, long after it became generally known that equally good stone existed at their very doors, and which could be had at a cost not exceeding the freight rates from the East.

Multiplicity of railroads and consequent cheapening of freight rates, together with an increasing and discriminating demand, is gradually working a change in this, however, and while the long-established firms in the border states may continue to send a share of their goods southward and into the interior, they no longer control these markets.

In this connection it is well to note as one of the pleasing signs of the times, the gradual change which has taken place in the character of materials used either for building, decorative or monumental work. None of our larger towns and cities are longer characterized by a tiresome unity of materials, such as formerly rendered so monotonous the architecture of New York and Philadelphia. Instead is almost a bewildering, though in many instances vulgar and displeasing, variety. Thus, Washington, a city of but some 250,000 souls, shows in its public and private buildings, aside from a gneiss found in the immediate vicinity, granites from Maine, New Hampshire, Massachusetts, Maryland and Virginia; marbles from Vermont, Massachusetts, New York, Pennsylvania and Maryland; sandstones from Connecticut, New York, Pennsylvania, New Jersey, Maryland, Virginia, West Virginia, North Carolina, Ohio and Nova Scotia; serpentine from Pennsylvania, and limestone from Maryland and Indiana. It is probable that an equal or greater variety prevails elsewhere. Especially worthy of commendation is the rapid change which has taken place in the substitution of granitic rocks for marble in cemetery work. In place of the monotonous rows of dirty white more or less disintegrated slabs of marble which but a few years ago alone were prevalent, is now found a pleasing diversity of more enduring colors and shapes, cut from granite and trappean rocks. The so-called "black granite," a gabbro from various sources on the Maine coast, is one of the most pleasing of these rocks for the purpose mentioned.

There has been within the last few years quite a marked change in the method of conducting the stone business, particularly so with reference to monumental work. This is due largely to the introduction of machinery. The old-time method of hand channeling or blasting by a single hole made by hand-drills has been almost wholly superseded by steam drills,

gadding and channeling machine, and the more complicated "Knox system" of blasting. In stone working, steam saws, planers, grinding and polishing beds have largely superseded hand methods. Machinery is, however, expensive, and the cost of running high. It is a necessary consequence that the manufacture of monumental material has fallen largely into the hands of the larger and wealthier firms. It is now no longer customary for a dealer in cemetery work to manufacture even a small proportion of the goods he handles. On the contrary, the materials are purchased, complete, with the possible exception of the inscriptions, from the manufacturers, who issue illustrated catalogues and price lists as in other branches of trade. The change as a whole is eminently to the advantage of the buyer, since not merely are prices reduced, but he is enabled to select, in most cases, a satisfactory piece, both as regards material and design from the stock in hand, while there is no ground for complaint as in many branches of manufacture that the ready-made, machine-made article. is in any way inferior to the product of the old hand processes.

THE USE OF GRANITE IN MONUMENTAL WORK—THE MODEL.

It may not be without interest to note in this connection the comparative ratios between the capital invested in quarrying, the annual running ex-

penses and the value of the annual output as shown by the census returns.

This is brought out in rather a striking way in the following table, in which returns from only a few of the more important states are selected:

Kind of Stone.	*State.*	*Capital Invested.*	*Total Running Expenses.*	*Value of Output.*
Granite	Maine	$3,192.317	$1,823,976	$2,225,839
	Massachusetts	2,235,759	1,973,729	2,503,503
	New Hampshire	761,362	597,491	727,531
	Rhode Island	646,392	789.219	931,216
Marble	Georgia	2,373,627	147,086	196,250
	New York	1,033,461	260,804	354,197
	Tennessee	815,500	263,741	419,467
	Vermont	9,346,928	1,739,988	2,169,560
Sandstone	Colorad	2 009,484	902,768	1,224,098
	Connecticut	1,896,957	710,772	920,061
	Massachusetts	373,862	509,649	649,072
	New Jersey	814,965	459,779	605,859
	New York	1,288,641	967,275	1,177,822
	Ohio	5,075,660	2,277,735	3,046,656
	Pennsylvania	2,132,056	1,385,890	1,875,115

In the granite industry a curious feature is here brought out, in that the value of the annual product so frequently equals or exceeds the entire amount of capital invested. This must not, however, be taken as indicating that the industry is an unusually profitable one. It means rather that a large share of the value put upon stone, is due to the labor which has been expended in getting it out and preparing it for the market. The amount of machinery and other appliances employed is often surprisingly small. In many instances of quarries doing a very considerable local business the entire value of all appliances

THE USE OF GRANITE IN MONUMENTAL WORK.
Partial Reproduction in Granite.

even including cattle hauling, would not exceed one thousand dollars. In such cases the work is of course nearly all done by hand. The larger and more wealthy firms are now employing machinery to a great extent, but even here the same ratio not infrequently exists. Indeed, it is difficult to suggest an industry which seems by nature better fitted to furnish a substantial share of prosperity to a community, than that of quarrying and working stone. Given a material which itself alone is of little value and which occurs in well-nigh inexhaustible quantities; for which when prepared there is a fair market, but which first requires a considerable amount of both skilled and unskilled labor expended upon it; which, owing to weight and hardness, requires the labor of many men, boys, teams, railways and boats ere it is finished and reaches its final destination, and consider how admirably all this tends towards fair and equitable distribution of the capital employed. It is doubtless to this fact that is due the comparatively greater degree of prosperity manifested in any quarrying community over one employed in almost any other branch of mining, either of coal, iron or of the precious metals.

George P. Merrill.

STONE and MILLING are the titles of two monthly trade magazines published by D. H. Ranck Publishing Co., Indianapolis, Ind., in the interests of these respective industries. When we say "trade magazines" we must not be interpreted as meaning publications of the slip-shod order, as unfortunately too many of the weeklies and monthlies are which believe they have a mission in the literary world, but which tax the forbearance of their readers by the crudity of their appearance and the lack of intelligent supervision in their make-up. STONE and MILLING are, we believe, the two handsomest trade magazines which come from the press. The style is that of the high-class monthlies, by comparison with which publications they do not suffer either artistically or typographically.—*The American Artisan.*

THE DECORATIVE FEATURES OF SCULPTURE.*

IT would be pardonable in me, perhaps, if I looked a little ahead to see, in the now rapidly developing recognition of the worth of women in public affairs, another source of difficulty to the future sculptors, if their only chance for distinction lies, as it does now, in portrait statues too; and difficult as it now is to make a male standing statue in modern costume suggestive of the figure beneath the garb, still greater will the difficulty become when dealing with the fashionable dress of the other sex.

Let us, for all reasons then, be prepared for the erection of the coming memorials by having homes made for them in buildings that are now being constructed, so that architect and sculptor may combine together and work out, each in their several ways, one common idea. To do this would be to return to our best traditions; it would emphasize the object of a building, and by accentuating the past deeds of great men in the scene of their labors, serve as a stimulus to coming generations.

With this simple principle in our minds we shall be better able to understand how it is that the sculpture of the end of the last century and the beginning of this has so little of permanent value or interest to us, although the sculptors were, individually, often men of great ability; one or two, indeed, such as Roubiliac, of exceptional ability. One feels that the works of men like Bacon, Banks, Wilson, Gibson and others is misplaced, or, rather, as if they were not intended for any particular place at all, but were executed for a museum and for any old corner where there was room. They do not touch us as they should, in spite of, as in those by Roubiliac, their great merit in execution. But not only are they not decorative in treatment, they are not representative of the leading thoughts of that age. I suppose the two leading ideas of that time were the establishment of our colonies and the abolition of slavery. Yet neither of these great subjects inspired our sculptors then—at least I can think of no important work that would typify them. When not engaged upon portrait statues, their skill was exercised in creating a Venus, a Diana or a Cupid, which, at the most, could only rank as conventional classical imitations, not especially beautiful in themselves, and possessing for a future age none of that archæological intërest that work, true to the thoughts and aspirations of its own time,

*A lecture delivered in the Applied Art Section at the Society of Arts, London, by Mr. E. Rosoce Mullins.

must always have. The chief exponent of this conventional art was John Gibson; to me there is a special sadness in looking back on his life and works. We are conscious now of the weakness of his work; but, even in my student days, most art lovers that I came across esteemed him as the finest sculptor of the day. It is not that fashion has shifted from classical standards to the freer development of the Renaissance-- lovers of art will always love the best Greek sculpture—but it is the want of aim in his work and their isolation from the thoughts of the time that has brought this neglect. There is a warning note to sculptors in the words of his will, by which he bequeathed his casts to the nation :—"Yes, I do feel," he wrote, "that the collection of my models, seen together, would be of use to young sculptors as to style." Now, not a soul but the very curious goes near them, and the works represent a splendid gallery of an art that is dead, because created apart and away from the needs of the time and the sympathies of the nation.

Flaxman's work was a glorious exception to this conventional art, and redeems this period from the wholesale condemnation that would otherwise be justly meted out to it. His reliefs are especially decorative, and when placed effectively, as I have seen them, they have great power in accentuating the purpose of a building. Those that I refer to are panels from the Lord's Prayer series, and are let into the wall at the east end of a church, alone occupying the space where they serve as true sermons in stone, without need of comment or words of any kind. Such I maintain to be instances of true religious decorative art. The inevitable result of detatching sculpture from architecture, and looking upon the art as independent of other arts and capable of stirring sentiment alone and unattached, is this harping back on the old masters and following in grooves dug out by them, working, that is to say, according to theories rather than up to required needs.

Theories must always be cramping and dangerous if meant as a guide to future production. In sculpture it has proved itself to be especially so, because the art has been such a happy hunting ground for the critic and connoisseur. Theories are only interesting as gathering up and focusing what has been done, but not at all in deciding upon the form future work shall take. Of all theories, that based on the search of beauty is perhaps the most destructive of all original talent, and yet it is the one most frequently set up. Even Goethe, with his width of view and knowledge of the manysideness of life, when commenting upon Lessing's Laocoon, says: "The former (that is sculpture) had to confine itself within the limits of the beautiful," and, again, "Sculpture labors for external sense, which is satisfied only by means of the beautiful." An artist, it seems to me, who is seeking for beauty, is as a man seeking for happiness as the one aim in life—a desirable end to attain, but never attained by directly planning or searching for it. And it is the same with the attainment of beauty in sculpture; the end is

only reached by having some definite and tangible object in view, while the mere search for beauty only leads to imitation and trite conventionality. But let the immediate purpose of our work be the desire simply to tell a story and adapt it to the place that the work is to fill, then, in this happy filling up of space, the element of beauty will possibly be there without our striving especially for it; at any rate, the work will be stamped with our own individuality, and that is an element always of interest.

Not only is it pernicious to the originality of the worker himself to be perpetually seeking only for the beautiful, but it derives the work of an element, the value of which, it is true, is more appreciated by future races than at the time of execution. I refer to what I have already alluded to as the archæological side of art. How much have we not learned of previous inhabitants of the world simply by the knowledge gleaned from their decorative sculpture. Besides well known instances, such as the Egyptian reliefs, which give us the whole range of the nation's pursuits, take the case of the early and little-known race of the Hitties. What is known of their previous history and the knowledge of their far-spreading dominion have been chiefly derived from the study of their sculptural reliefs. The presence of the mural crown and the double-headed eagle, in association with a certain ever-recurring decorative pattern, and the top-heeled boot, the high-peaked turban, the short high girded sword, etc., these and other features all point, when found on slabs scattered over Asia Minor and elsewhere, to the presence of that early race. Again, much remains yet to learn concerning the Mexicans, when the curious hieroglyphics have been deciphered.

It is certain that this interest at least, will be wanting to future antiquaries if it is found that our works refer to a mythology foreign to our country, to heroes and gods not believed in by our race, and merely copied because they were nude. "What's Hecuba to him or he to Hecuba?" may well then be their cry. If we cannot invest our works with any lofty ideas, we can at least be true to the conditions of the time; and this we should much more readily be if sculpture were the result of a demand from the public instead of what it so often is—the outcome of a chance action seen by the sculptor in a model in his studio, to which work he afterward appends some learned Greek name.

While speaking of the danger of disconnecting sculpture from architecture, I should like to refer to two tendencies of the present day. One affects the art itself, and is, it appears to me, as pernicious to its free development as the old-fashioned desire to produce only something beautiful, and that is the influence upon sculpture of the sister art of painting, which necessarily follows from the importance given to the yearly exhibitions, especially at the Royal Academy, in which the preponderance of painters to sculptors is as nine to one. Truthfully modeled surfaces and the literal rendering of nature

naturally have more weight with a painter than with a sculptor, for, in painting, imitation of nature cannot be carried to too great an excess, and the most thoroughly realistic work will still bear the impress of art on its canvas; but it is not so with sculpture, for a plaster cast from life will give the exact imitation without any art at all. The result of this painter-influence leads often to the neglect of design, composition and all thought of suitability to any given place. The other evil to which sculpture is always liable, if disconnected with architecture, is to become the property of the few, instead of belonging to the nation as a whole.

In treating of the art from a decorative point, I have purposely kept my mind on the architectural side of sculpture as the most important form of decoration, but I would wish it understood that I apply the term, decorative sculpture, to the covering of any surface that needs decoration, be it what it may, from the walls of palaces and municipal buildings to fire-dogs, knockers, clocks, lamps, mantelpieces, jewelry, etc. Of course, these latter can never attain to the importance of architectural sculpture, for the reason above mentioned, that they must, for the most part, belong to the individual and not to the nation; but otherwise they merit as much thought and care as surfaces that are more pretentious. In this paper I cannot do more than allude to them, but the mere mention of the above list shows the enormous field open to the sculptor, and the very wide range of his art as a decorative one. Neither do I think it necessary to draw any fine line between the useful and purely ornamental articles. The æsthetic enjoyment of a fine knocker is, it is true, not in rapping with it, but the excellence of the artistic design and execution need not interfere with it as a useful article. I have often wondered by the way, who buys those marvelously carved meerschaum pipes that one sees exposed in the tobacconists' windows, and still more who smokes them. This is one of those instances, I think, when we may exclaim with the poet that "Beauty unadorned is adorned the most." I must confess I can give no reason, save as Shylock puts it, "A lodged hate and a certain loathing" I have to the "adorned" article in question.

The difficulty that arises with regard to making jewelry really artistic and worth the sculptor's attention is caused mainly by the fiend fashion; for it is impossible to justify fine work on an article that is decreed to be out of date a few months after it is made. The round brooch has to give way to the long, the broad bracelet to the fine and thin, quite independent of the workmanship and beauty that one or the other may possess. Yet great sculptors and painters in the past learned their craft and gained most of their valuable experience in the goldsmith's workshops, and our artists might do so again if this paralyzing influence were once removed. To sum up the few ideas I have ventured to express, I maintain first of all that sculpture must in the main be decorative, allied chiefly to architecture, and speaking to us from its

walls. When thus linked with architecture, I would have it free within these limits to develop the individuality of the artist and the characteristics of the time. I should wish it to be as true to latter-day life as possible, and thus be in touch with the age. If the artist has imagination, and can see through the surface of life into the hidden mystery of things, let him by all means represent it; if not, let him portray life as he sees it, and we will hope that the necessities of the conditions under which he works—that is, his architectural surroundings—will tone down any too strongly developed tendency to realism. Why, even our foe, the frock-coated gentleman, might not pose amiss when twisted into a miserere or a gargoyle.

Such are the few thoughts that seem to me to be important to us sculptors at the present day, and their importance to us means importance to the nation at large, for if art is to be of any use at all it must be in touch with the nation. As Mr. Frederic Harrison has lately said, when speaking of the great Gothic period of art and the memorials it has left to us: "These vast temples are the creation of generations of men, and the embodiment of entire epochs, and he who would know the Middle Ages should study in detail every carved figure, every painted window, each canopy, each relief, each portal in Amiens or Chatres, Rheims, Bourges, Lincoln, or Salisbury, and he will find revealed to him more than he can read in a thousand books."

PAPER FRICTION HOIST.

AN English firm is introducing an improved friction hoist for ware-houses, etc., a special feature of the construction of which consists of a pinion, having the rubbing surface formed of paper. In making the disk, says the *Paper Trade Journal*, a great number of thin sheets of paper are tightly compressed together by bolts passing through the central core of iron. Although the first cost of the paper arrangement is somewhat greater than that of cast-iron, it is claimed that this is more than counterbalanced by the advantages secured. As the friction between iron and paper is greater than that between two metal surfaces, less force is required on the hand cord of the operating lever to set the machine in motion. The paper will also adapt itself to the contact with the large iron wheel, and the latter will therefore, it is said, run true and require no facing, while the paper disk itself does not wear so rapidly as those constructed of iron.

DRAWING FOR WORKMEN—II.*

AFTER the drawing-board and paper are provided it becomes necessary to supply ourselves with squares of various kinds suitable for such work as may be required.

The T-square (Fig. 6), is a blade or straight-edge, *a*, made of walnut, ebony, mahogany, or other suitable wood, fitted at one end with a stock, *b*, applied transversely at right-angles. The stock is so formed that it will fit and slide against one edge of the board, the blade reaches over the surface, and presents an edge of its own at right-angles to that of the board, by which parallel straight lines may be drawn upon the paper.

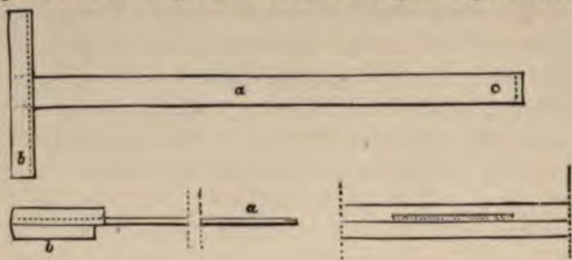


FIG. 6.

FIG. 7.

The blades may be made any reasonable length, but should never be less than two inches in width or three-thirty-seconds in thickness. The tip of the blade must be secured from splitting by running a saw kerf in it and inserting a piece of brass, tin or other metal.

The stock may be made about two inches wide and five-eighths thick, and from eight to fourteen inches long, according to the length of the blade. A rebate should be run in the stock, as shown at *b*, the object of which is obvious.

One-half of the stock, *c*, (Fig. 7), is in some cases made loose, to turn upon a brass pin to any angle with the blade, *a*, and to be clenched by a screwed nut and washer. The turning stock is useful for drawing parallel lines obliquely to the edges of the board. In most cases, however, the sectors and the other appendages to be afterward described, answer the purpose, and do so more conveniently. A square of this sort should be rather as an addition to the fixed square, and used only when the bevel-edge is required, as it is not so handy as the other.

The edges of the blade should be very slightly rounded, as the pen will

*By Fred T. Hodgson, author of "The Steel Square and Its Uses," through the courtesy of *The Operative Builder* of New York.

thereby work the more freely. It is a mistake to chamfer the edges—that is to plane them down to a very thin edge, as is sometimes done, with the object of insuring the correct position of the lines; for the edge is easily damaged, and the pen is liable to catch or ride upon the edge, and to leave ink upon it.

No varnish or oil should be used on a T-square, as the best oil or varnish will soil the paper. The natural surface of the wood cleaned and

FIG. 8.

polished occasionally with a dry cloth is the best and cleanest for working with.

T-squares are sometimes made with a hard-rubber blade and rubber edge on the stock, and may be adjustable or not, as shown at Fig. 8, or they may be made of soft maple, pear-tree wood or other suitable wood, and be edged with hard rubber, as shown at Fig. 9. The most useful square has the

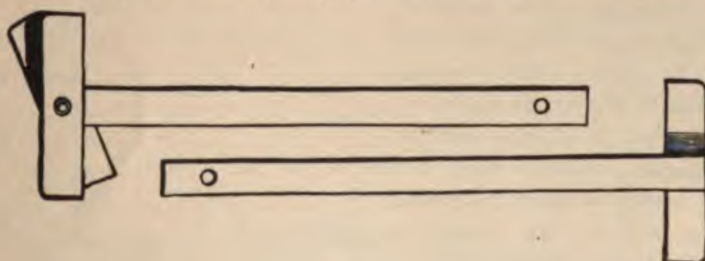


FIG. 9.

cross-piece, or stock, fastened permanently and securely at right-angles to the straight edge of the blade. Thereare many ways of fastening the stock to the blade, but the best, we think, is to glue and screw it inplace, seeing first that it is as nearly true as it is possible to make it.

The T-square is always used in connection with the drawing-board, and with it and a triangle or a set square, the straight and parallel lines of a drawing are very easily added; the head of the T-square being held

against the edge of the board, and the triangle or set square resting against the edge of the blade, along which it can be slid for making parallel lines; by sliding the stock along the edge of the drawing-board, other parallel lines can be formed. The edges of the T-square are apt to get abraded from constant use; to prevent this, it is well to have a hard-rubber strip glued on the edge, or better still, fasten on a brass strip. This will make the blade stiffer and less liable to warp or twist, and will allow the pen to work smoothly against it.

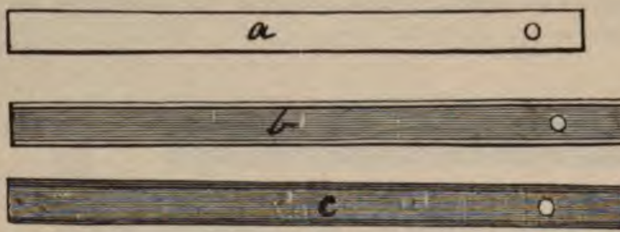


FIG. 10.

The angles of a T-square should be frequently tested to discover any inaccuracy if such there be, for a square that is not true, is a snare and a delusion.

After the T-square comes the triangle or set-square and straight-edges. These when properly applied, greatly facilitate the operations of the draftsman. They should be of close-grained hard-wood, as mahogany, well-seasoned; straight-edges, when 5 feet long and upwards, may be of ribbon-steel. Wood is more easily kept clean, and is less likely to soil the paper. Hard rubber also answers very well.

Straight-edges should, like square blades, be just broad and thick enough for the necessary stiffness, and beveled a little at one edge. The smallest may be 9 or 10 inches long, ⅞ inch broad, and ⅛ inch thick. Clean the square thoroughly with perfectly clean tissue paper first, and afterwards with clean white foolscap paper until it leaves no mark on the latter, then it cannot soil the drawing paper. Always clean the T and set square as above described, and there will be no reason to mourn over soiled drawings.

FIG. 11.

Three examples shown in Fig. 10, of straight-edges, *a*, is a plain strip of some suitable wood, beech, soft maple or pear-tree; *b*, is edged with some harder wood, such as maple or cherry; *c*, is glued up in strips and edged with ebony or hard rubber.

Triangles, or *set-squares*, as they are sometimes called, should be barely $\frac{3}{32}$ inch thick, and flat on the edges, to wear well. They should be right angled one of them, *a*, (Fig. 11), being made with equal sides, and angles of

45 degrees each; the other, *b*, with angles of 60 degrees and 30 degrees. The former, by means of its slant side, is very useful in laying off square figures; the vertical side, too, saves a deal of shifting of the T-square, as, when the horizontal edge is applied to that of the square, short perpendicular lines may be drawn by the upright edge. The most convenient size for general use measure from 3½ to 4 inches on the side. A larger size, 8 or 9 inches long on the side, is convenient for use in making large scale drawings. Applying one or other edge of the triangle, *b*, to the square, the slant side gives at once the boundaries of all hexagonal and triangular figures. This triangle may be of two sizes, 5 inches high and upwards. Of the two set-squares, the second is the more convenient for general use in drawing perpendiculars, as it is larger and has a shorter base; and is more easily handled. Still sharper set-squares are sometimes used, also compound triangles, having the slant-edge broken into two lines of different slopes. The latter are not to be recommended. Circular openings are sometimes made in the body of the triangles for facility in handling. They are of no great use in that respect, but they allow of the triangles being hung up.

Triangles are further useful in connection with each other, or with the straight-edge, for drawing short parallels and perpendiculars without the use of the T-square, as shall be exemplified in the proper place. They may be made of almost any good wood, but the best are made of mahogany and edged with ebony or hard rubber, or they are made altogether of hard rubber, and when made of the latter material, they may be left thinner than is safe to leave them of wood.

[TO BE CONTINUED.]

PREHISTORIC QUARRIES.

AN expedition sent out by the Bureau of Ethnology for the purpose of making collections to illustrate aboriginal quarrying and mining at the Columbian Exhibition, has just returned to Washington with a remarkable and most interesting assemblage of objects secured. Among these objects are a number of pipes and fragments of pipe-stone obtained from the famous pipe-stone quarry in Southwestern Minnesota, whence the Indians of North America have got the material for their pipes since very ancient days, long before Columbus landed on this continent.

From that time down to the present the working of this same mineral deposit has been kept up continuously, even the savage Sioux traveling two hundred miles to spend a month at the quarry.

For centuries the place was regarded as sacred, and all tribes met there, preserving peace religiously while on the spot. For miles around the quarry the plains are covered with the rings which mark the sites where Indian lodges were once established, and everywhere are scattered fragments of pipe-stone representing the waste of manufacture. This material seems to have been selected by the savages because of its beauty and softness when fresh. The latter quality renders it easy to carve, while subsequently it becomes extremely hard. Its color is an exquisite "Indian red." Much of the carving work done on the pipes is of highly artistic quality. Some of the specimens secured by Prof. Holes, who made the collections referred to, would do credit to the most skilled workers in meerschaum.

The pipe-stone deposit described is the only one of its kind in this country. It is a stratum of an unusually hard red clay, the edge of which is exposed along the side of a hill. At the beginning there could have been no difficulty in procuring it from its native bed, but the labor of quarrying it has become very great, owing to the fact that the edge of the stratum has been removed, and, in order to get more, it is necessary to dig down through several feet of quartzite. The stratum being horizontal, the slant of the hill covering it makes the toil incidental to working the quarry progressively more severe. Pickaxe and shovel are the implements utilized for the purpose by the Indians, who have not as yet learned the art of blasting.

On account of the difficulties attending the mining of the pipe-stone, it is quite a precious substance, a piece one foot square being worth from $2 to $3 in the crude. The stratum described is about twelve inches in thickness

and seems to be evenly continuous for an indefinite distance through the hill. However, only two inches of this thickness is of good quality, being smooth to the touch and free from grit. Of recent years the Indians have learned how to inlay the pipes with silver and other metals, performing this kind of work in a manner very artistic. They do all the pipe-making, the labor involved being too great to pay the white man for his time. White people buy the pipe-stone and make many other articles out of it for sale, from a complete house down to miniature pieces of furniture and trinkets.

The fact that this pipe-stone quarry was regarded as sacred is indicated by extensive pictographs on the rocks in the vicinity of certain huge bowl-ders found on the spot, representing aboriginal gods and other things of religious significance.

Professor Holmes also visited the wonderful prehistoric copper mines of Isle Royale, in the northern part of Lake Superior. These were worked long before Columbus was born, by the Indians, who procured from them metal for their implements and ornaments. The copper occurs there in masses of the pure and "native" metal, imbedded in the volcanic rocks, and the primitive miners were accustomed to dig it out with no better tools than stone sledges. Although the island is not adapted for human habitation, tribes from all the surrounding country gathered there in ancient times for the purpose of obtaining the precious material. In order to find it, a great deal of "prospecting" had to be done, and thus the surface of the hills to-day are everywhere covered with old pits and trenches, partly filled up and overgrown with pine forests.

In these ancient holes are discovered numerous stone implements which bear the marks of use as mining tools. So thickly are such rude tools scattered about that not less than 50,000 of them are to be seen on the surface of the ground, affording an illustration of the extensive character of the work that was carried on. The copper was something found in masses so big that they could not be removed, and many such gigantic nuggets of pure metal have since furnished bonanzas to the whites, who for years made a business of exploring the old workings in search of them. One nugget weighed 12,000 pounds, and, because it was not practicable to cut it up or blast it into pieces, it had to be conveyed bodily to the lake shore and carried away in a vessel, requiring much ingenuity and the best modern appliances for the successful accomplishment of the task.

When the Indians came across such a mass of copper, the best they could do was to break off a few projecting pieces of it. The business of prospecting for such abandoned nuggets was finally given up by the whites because they ceased to find enough of them to pay, although more than 1,000 bits remain untouched by them. After the miners of antiquity had got the copper, they hammered it into tools and ornaments, which were carried into

all parts of of North America and distributed by trade. Such articles, for which the material was originally obtained from Isle Royale, are found to-day in mounds and graves throughout this country. This exploration by the Bureau of Ethnology of these great prehistoric workings for metal is the first that has been made, and the results, which will be illustrated by collections exhibited at the world's fair, throw a new light upon the aboriginal people who have left behind them proofs of such gigantic labors.

Considering the vast extent of the country and the lack of but the most primitive means of transportation, it is certainly astonishing to discover how general was the system of trade existing among the savage tribes of North America at the time when Columbus landed. The pipes, for which the material was procured at the quarry previously described, were distributed by barter from the Atlantic to the Pacific, just as was the case with the copper ornaments and tools got from the mines of Isle Royale. It was nothing unusual for traders to journey all the way from the Gulf of Mexico up the valley of the Mississippi to the very source of the Father of Waters, exchanging goods with the tribes on the way. Dried mollusks of various edible kinds were carried far into the interior, as well as marine shells for money and ornaments, to be disposed of in return for skins and other goods.

Prof. Holmes on his recent expedition visited a prehistoric quarry in Arkansas where flint for flaking into tools and weapons was procured on so extensive a scale that in places the hills and mountains have been actually remodeled by the pittings and trenchings. From one hill-side it is estimated that upwards of 150,000 cubic yards of flint have been removed and worked. Another locality explored in Indian Territory yielded for the purposes of the aborigines a chalky-kind of flint, which was procured in enormous quantities for making large implements, such as hoes and other agricultural tools, and also knives that were very long, slender and thin. It was usual to select the pieces of best quality for the manufacture of knives, just as nowadays the finest steel is employed for cutlery. A third great quarry, in Ohio, near Newark, worked on a very extensive scale, supplied a beautiful flint of fine grain for arrow-points and spear-heads. It furnished with these articles an extent of territory equal to half a dozen states, and they are found to-day as far south as Tennessee and as far east as New York. —*Rene Bache, in Philadelphia Item.*

NEW ENGLAND NEWS AND NOTES.

FIRST of all in interest is the lockout and strike, or the failure to renew the bill of prices, whichever characterization one may give it. The end is practically the same as far as business is concerned—it is a cessation of labor. As this is written there is no change of any consequence in the situation. Neither side seems likely to give in, and there seems to be a disposition to prolong it on the part of some of the manufacturers which does not augur well for a settlement this fall. However that may be, the number of idle workmen is constantly decreasing, and before many more months have passed the question will probably solve itself partially by a complete change of location on the part of a large part of the workmen. In Concord, N. H., there are now about eighty out of work, where there were four hundred and fifty. It is reported that the decrease in the number of idle men is about the same accordingly, everywhere.

An adjourned conference was held in Boston, Friday, August 19, between the executive committees of the Manufacturers' Association and the Cutters' National Union. The first offer of the manufacturers was to make the date of the expiration of the bill February 1 instead of January 1, but the Union declined to accept it as modified. After a discussion of the various phases of the situation, President Smith, in behalf of the Cutters' National Union, submitted the following proposition as a basis of settlement:

Resolved, That it is agreed between the Granite Manufacturers' Association and the Granite Cutters' National Union that all bills of prices expire on March 1, 1895, and that any grievance that may arise between any of the branches shall be referred to three members of each of the executive committees of the associations, and if they cannot arrive at any agreement then they may call in any judge they may agree upon, and their decision shall be final.

That was rejected by the manufacturers. The following was then sub stituted:

Resolved, That it is agreed between the Granite Manufacturers' Association and the Granite Cutters' National Union that bills of prices shall be continued for a period of three years from date of this agreement, and, shall either party desire a change, they shall give at least three months' notice before such changes are expected or asked to go into operation.

Any changes desired, if not satisfactory to both parties, shall be laid before a local board of conciliation consisting of three from each party interested, and if it cannot be settled by them it shall be referred to three members of each of the executive com-

mittees of the associations; and if they cannot arrive at an agreement then they may each select a disinterested person and the two so selected to request the judges of the supreme court of the state where the difficulty arises to select the third, and their decision shall be final.

Pending such arbitration, the Granite-Cutters' National Union agrees that its members shall not strike or suspend work, and the Granite Manufacturers' Association agrees that its members cannot lock out their workmen or suspend business, thus avoiding any possible conflict on any question whatever.

That was also rejected. It was then the manufacturers' turn to introduce a proposition and the following was the outcome:

That the Manufacturers' Association sign bills with the Stone-Cutters' National Union for a term of years to terminate Feb. 1, 1895. The stone-cutters to return to work under the old bills of 1891, which were in operation at the time of the suspension of business in all localities, and any slight changes in the bills to be agreed upon by the local association and union.

Should either party desire a change at the expiration of the bill, four months' notice to be given by either party previous to Feb. 1. The existing bills to continue from year, to year, notice to be given as heretofore provided. The number of apprentices to be employed shall be discretionary with the employers, and no discrimination to be made between union and non-union men.

The board of arbitration to consist of three from each executive committee, to be an appeal board. This proposition is made with the understanding that the same is to be accepted by the Granite-Cutters' National Union committee on or before Aug. 25, 1892. Should the above proposition not be accepted on or before that date, then this proposition is withdrawn, and we decline to have any further conferences.

The proposition was not accepted August 25, and therefore the Union is shut out from any further conferences in the matter.

Thus the matter stands, and thus it seems likely to stand. Meanwhile business enterprises languish, and the outlook for additional business in such a town as Barre is not bright. It is impossible to call in additional capital as long as such a condition of things in the chief industry exists; and the fact remains that all manner of business of other sorts is longing for the war to close, and the granite men go to work again as of yore.

The Sunapee, N. H. Granite Company has leased its quarries to Jonathan Keast for five years, and Mr. Keast will push things there from now on.

The Blue Mountain Granite Company of Vermont, Alex Cochran, manager, is doing a constantly increasing business and turning out a fine quality of stone.

The Excelsior Granite Company of Montpelier, Vt., is making a unique polished sphere monument, five feet in diameter at the base. The stone in the rough weighs twenty tons, and is for parties in Norwich, N. Y.

A Portsmouth, N. H., correspondent says that G. W. Andrews, the contractor who is to have charge of the new breakwater at Little Harbor has

arrived, and work will be pushed as rapidly as possible on the improvements to be made there. The sloop United States has been moored in position, and the derricks for the removal of the stone are erected.

The apprentices at Barre struck about the middle of August, the difficulty growing out of the employing of non-union men in the sheds where they worked. Twelve to twenty apprentices resented the employment of non-union men. Marr & Gordon sued one apprentice for damages, but it has never been given out what the reault was.

C. E. Tayntor & Co., of Barre, announce that their new granite shed was ready for business Aug. 29. They made announcement some time ago that they should make individual contracts with fifty cutters if the trouble was not settled on that date. What the result of their attempt to make such contracts hasn't yet been reported.

The Barre Manufacturing Company has filed articles of incorporation with the Secretary of State. The capital stock is $10,000. The purpose of the organization is to secure for the granite industry of Vermont, adequate representation at the world's fair.

Holden's soapstone quarry in Perkinsville, Vt., is to be re-opened at once. An engine and derrick were put up there the last week in August, and the work of excavation is going on now. The quarry has been abandoned and re-opened a good many times, several causes having contended against a successful persecution of the work upon it. Probably now there will be no drawback.

The granite industry in Windsor, Vt., is going on as finely as one could reasonably expect. The steep road up the mountain-side, for which the town contributed a number of hundred dollars, is in good condition for work. At the quarry itself, the blacksmith shop is in running order, and the derrick is ready to be set up. But the season has gone so far now, that it will be too late to do any very extensive work before another spring, probably.

An impression has got abroad that the architect of the New Hampshire world's fair building was not a native of New Hampshire. That is erroneous. His name is George B. Howe, he is a native of Concord, where his parents still reside and where he makes his home. None but New Hampshire architects were allowed to contest for the honor of designing the building.

August 15, C. C. Cheney, secretary of the New England Manufacturers' Association, sent out a tabulated series of figures giving the status of the granite lockout as far as the New England Manufacturers' were concerned,

the figures being furnished by the manufacturers themselves, and showing the number of men at work at that time.

	Maine.	*New Hampshire.*	*Vermont.*	*Massachusetts.*	*Rhode Island.*	*Connecticut.*	*Total.*
Journeymen—							
Granite Cutters	85	20	79	285	41	25	539
Apprentices—							
Cutters	45	65	301	304	50	37	802
Paving—							
Cutters	162	25		177	4	2	370
Quarrymen	399	103	290	532	146	199	1,696
Blacksmiths	46	14	66	92	24	18	260
Others	86	40	105	206	183	80	700
Total	823	267	841	1,569	448	362	4,340

The Concord and Montreal railroad has built a new passenger station at Laconia, N. H., the building being dedicated August 22. The general style of architecture is modern English with a modified Romanesque treatment. The exterior is of Milford, Mass., dark pink speckled granite and the trimmings are dark red freestone from Long Meadow, Conn. The main features of the building, are the port cochere at the entrance and the waiting-room or rotunda, open to the roof with clear-story windows on all sides. The floor is of tile and the walls are finished in quartered oak to ten feet above the floor, and above are plastered in two shades of chromes. All the other rooms are on the same generous scale, and the entire structure is the handsomest station but one, along the entire line, the station at Concord only being better.

Bradford L. Gilbert, of New York, was the architect, and S. S. Ordway & Co. of Woburn, Mass., were the contractors. The contract was signed April 28, 1891, and ground was broken June 10 of the same year. It took fourteen months to build, and the whole is a monument to the painstaking care of Nahum Robinson of Concord, superintendent of building and construction for the Concord and Montreal road. The total cost was from $50,000 to $75,000.

There has been no act of violence in any of the New England towns where the lockout and strike has prevailed among the granite workers. Saturday night, August 13, the stone shed of John Swenson of Concord, N. H., was entered and a hammer taken with which the corners were knocked from a hammered monument base, a polished gable die and a polished Gothic cup. The hammer was taken from the firm's blacksmith shop, and an entrance was effected through a rear window. The local manufacturers'

association offered a reward of $100 for the detection of the criminal, and that was supplemented by a similar reward from each, the New England Granite Works and the owner of the sheds. So far, no clew has been found. It is not likely, however, that any of the locked-out men did it, for they are not fighting that way in this section of the country. They leave that to Homestead and Buffalo strikers; while here they intend to win by tiring the manufacturers out.

The Roxbury Granite Company of Roxbury, N. H., is developing a large business. The quarries are located just across the Roxbury line from Keene, in a good district for transportation. The company is now employing about forty-five hands. A block was recently quarried which was seventy-eight feet long, seven feet two inches wide and four feet thick. It was started with small wedges and split as straight as if cut with a saw. It is without a seam or a stain, and weighs two hundred and twenty tons.

In this trouble between the dealers and the workmen the outside public has little general interest beyond the fact that business of all kinds has suffered to a great extent. The only thing the public cares is that all sides have fair play. For that reason one will hear the men who are uninterested in either side of the case say that it should not be denied the firms to employ non-union men or anybody they can get and then on the other hand they will say that all firms should be allowed the privilege of withdrawing from the associations at any time and starting business for themselves as they choose.

Saturday, Aug. 27, it was announced that Barclay Brothers, one of the largest firms in Barre, had withdrawn from the association, signed the bill and would set forty or fifty men at work the following Monday. The following Monday came and with it the announcement that an injunction had been served upon the firm, forbidding them to do business on the ground that it injured the business of other firms. So far as that goes it yet remains to be determined, but the fact remains that this is a free country and the association cannot compel any firm to remain in it. The firm gave bonds and will fight the association in the courts. Thus arises another interesting question.

A coöperative granite company with a capital of about $20,000 has been organized in Concord, N. H. Some of the stockholders are the most important business men in the city, and every dollar of the stock has been taken. September 2, the stockholders met for temporary organization and work will begin at once.

Daniel and John Frasier, who have been in the granite business at Concord,

have dissolved partnership. Daniel has gone to work for John Swenson and John continues the business alone.

W. H. Perry, of Concord, N. H., the man who withdrew from the local manufacturers' association and went to work, has increased his business largely. He is now employing between forty and fifty hands, and is running two fires. Another fire will be started soon and the force of hands still further increased. He is, at this writing, setting the bed for a new one hundred horse power engine and boiler to furnish additional power for polishing. The great drawback in Concord now is lack of polishing facilities. After this new engine is in he will be ready to furnish power for all who come.

Mr. Perry is going to test the validity of some of his monument design patents in the courts this month. John Flood, a manufacturer of West Concord, has been using the designs without authority. Mr. Perry proposes to have the question settled once for all as to whether a patent is valid. Good counsel has been engaged and the fight will be a test question.

Another thing Mr. Perry is now interested in is a new sliding bicycle seat, his own invention, which seems to meet the difficulty of up and down hill riding.

To a representative of STONE Mr. Perry said that he was in business for Perry and not for the association. Hence his withdrawal.

THIS IS A FREE COUNTRY.

There are certain things the labor organizations must learn. The first is that they cannot succeed in the absence of the support of public opinion. With this support they may not always succeed, but without it, victory is utterly impossible. The next fact to be borne in mind, is that public opinion in the United States will never countenance the invasion of personal liberty. With us, each individual who has not by his crimes against society brought about his imprisonment, is a freeman, and as such is not only entitled to the protection of the laws, but also has the right, so long as he breaks no legal statute or ordinance, to employ his time and energies in such manner and under such conditions as he may see fit. Of the 18,000,000 or 20,000,000 of workers in the United States properly not 1,000,000 are definitely affiliated with labor organizations, and even if 99 out of 100 of our citizens were so affiliated, they would have no right to lawlessly impose their will upon the hundredth man.—*Boston Herald.*

D—*Stone*.

A MANTEL FROM THE FRENCH CHATEAU AT BLOIS.

THE RENAISSANCE IN AMERICA.

THE photographic print shows a mantel from the French chateau at Blois. This chateau was built during the time ot Francis I. A view of the exterior stairway was given in the last number of STONE. This work shows the best of the early renaissance. It is the style which is being studied and copied by many of the architects of this country at the present time. Yet it is sad to think that we may not expect to equal, to say nothing of surpassing the renaissance work of this period. At most, all that we can expect is to have indifferent copies. We, as proud Americans, who believe that we can do anything and everything a little better than most any one else, are slow to acknowledge a statement of this kind. Yet there is every reason why this statement should be true and no reason why it should be contradicted. It is only a few years ago that our architects were for the most part blindly and mechanically copying romanesque forms. Now the same architects, with an ease, a glibness, a flippancy, turn round and at once are renaissance architects. They talk to the public about the present popularity of the renaissance style. They design in that style, and, with the assistance of their draftsmen, make copies in renaissance detail, and we have at the present time, a well developed case of renaissance fever in America. However, this is an architectural disease which is not contagious, it is sad to relate. Well developed renaissance forms are not readily absorbed nor in new work do they readily show themselves. We are engaged in blind, unskillful and unhappy representations of early renaissance work. As said before, this task according to present methods, is popular. We do not start in right. We commence at the end rather than the beginning. We take the work which these people have done, its results, and study and adapt them directly. We do not consider the conditions which gave these results birth; we do not consider the history which developed them, nor the experience of the people who have had to do with them. The men who did this work were trained through generations of experience. They were surrounded with the best of examples, the best of inspiration, and what is more, they had little more than the work in hand to engross their attention, at the same time there was a division of work. The architect was not the decorator; he was not responsible for all of the bits of sculptural work or distinctive detail which had to do with the completion of the building. He designed the mass and controlled the forms to

that extent, making his drawings as to the outlines of his mouldings, and general designs of decoration. For instance, in this mantel it was never in doubt in the original drawings that there was to be a band of decorative work immediately over the fireplace opening. Also that the panels of the pilasters were to be sculptured, and furthermore that the large panels in the center of the fireplace were to have important bits of decorative work, even if the drawing did not necessarily suggest the distinct forms. It was here that the sculptor came in and modeled his work in all probability first in clay, and then cut it in the stone. The stone was set up in blocks without their mouldings, or any suggestion other than in block form, as to the character of the work to be done. It is easy to see that under such circumstances the sculptors and decorators had great freedom. Even mouldings could be changed, or if they thought desirable certain mouldings could be left out, and in many ways the general features of the design changed in keeping with the leisurely, sincere work which was done in connection with the strictly decorative part of the work. This was the method. It was the plan of doing the work. There was required in the first place, an architect. One who was familiar with the work of the time and history of that which had gone before; a man full of the artistic instinct, yet willing to consult with and be influenced by artists, who gave their particular time and attention to detail. The sculptor was the one who had a knowledge of architectural composition and the definite relation which existed between the work of the decorator and that of the architect. He assumed measurably the same position with respect to the architect that the architect did with him. This is another detail or method leading to good results, yet it is not all. These men came along after the decline of the Gothic architecture. They were influenced by its exuberance, its freedom and its brilliancy. They and their ancestors were a part of it. They were the exponents of this kind of work. They had made it. They understood it in all its detail. In changing over from the period of the Gothic architecture to that of the early renaissance, they were full of the architectural spirit, full of the training and tradition which has developed this florid architecture, and in bringing themselves under the influence of the early Roman decorative forms, they had not alone this knowledge and the experience of centuries before them, but they had the spirit and the life of the Gothic architecture to unite with it and the result is what we see. These men had been born and bred to artistic work through the centuries which had passed. It was not merely a part of their lives, it was their lives. They lived for it; to create; through generations they transmittted the interest and knowledge which made true artists. The work of this time and the centuries which had gone before was all beautiful. In viewing the architecture from the thirteenth well into the sixteenth century, there was nothing which was gross

or ugly or common. All the work that was done was essentially beautiful. It was refined. The artists who were educated under this influence could not go astray. They had no precedent for ugly things. Beauty was common. It was before them all the time. Furthermore, they were not ambitious to change. The Romanesque architecture as we know, went through the eleventh and twelfth centuries. Three hundred years were given to the development of the Gothic architecture. The field of Gothic architecture having been exhausted as it would appear, they moved slowly into the revival of the old Roman forms, and we have the renaissance. All of these changes were made gradually and slowly and under the surroundings of nothing that was ugly, nothing that was common. All that was beautiful, chaste, artistic. There was no chance to go wrong. There was the training of the minds and that which guided the hand. Have we such schools now? Have we such surroundings? Have we generations of unbroken success to guide us?

In France to-day, the modern work is far from satisfactory. There is always a refinement of detail, a delicacy in execution. We never find anything that is clumsy and rarely that which is ugly. However, there is a lack of the old spirit which develops this high class-work. The architects and artists of the present time in France, are working in a different school, which it is evident to those who look, is inferior to those of the times of the early renaissance. The French renaissance of to-day is another architecture. It is born of a different spirit. It is surrounded by formula, rules, regulations. Enthusiasm is hampered. The foundation of the school is tradition. They see nothing ahead of them, hence, while the work always has good proportion, good form, well executed detail, there is little of it which has that fine exuberant, aggressive character which belongs to the period of Francis I, and that which came immediately after.

The architectural outlook in America is not encouraging. We undertake to do too much. All of our undertakings are full of assurance. We are for the most part, without knowledge of architectural detail, architectural forms or general composition. We are confident, aggressive, and withal quite crude. This is a gloomy view of our architectural status. Possibly through it some one may be led to realize our true situation and commence with the foundation principles and work up from it.

Louis H. Gibson.

CHARLES A. PFEIFFER.

CHAS. A. PFEIFFER, the subject of our frontispiece, was born in Sigmaringen, Hohenzollern, Germany, Dec. 19, 1844, and is therefore at present in his forty-eighth year. Four years after his birth his father emigrated to America, and a year later his mother followed, taking her son with her. His father was a practical stone-cutter, at which trade he readily found employment in New York, Philadelphia and Chicago, respectively, in which cities the son was given the benefits of a common school education. While yet a mere lad he assisted his father in his labors and the thorough methods acquired by the father in the mother country were gradually instilled into the mind of young Pfeiffer, who was also taught how to sketch and draw, to estimate on cut-stone work and prepare himself generally for the requirements of the trade he had adopted. Having acquired a thorough common school education, he entered a commercial college attending evening sessions. At the age of 24 he became his father's associate in the business which had been established eight years before, and the firm name was changed to J. Pfeiffer & Son, under which title it was conducted until 1881, when it was incorporated under the laws of Missouri as the Pfeiffer Stone Co., of which Charles A. is president, with headquarters at St. Joseph, Mo. At the annual meeting of the Missouri Valley Cut-Stone Contractors' and Quarrymen's Association, held at Kansas City, Mo., Jan. 26, 1892, Mr. Pfeiffer was elected its president and was delegated to attend the convention of the Ohio Valley Association for the purpose of effecting relations insuring a uniformity of action relative to issues affecting cut-stone contractors generally and those of the Ohio and Missouri valleys particularly. This he accomplished to the satisfaction of both organizations.

APPARATUS FOR DETERMINING THE WEAR ON PAVING MATERIALS.

AN apparatus is in use at the government testing station at Charlottenburg, Berlin, employed to determine the wear on paving and flooring materials, which as described in the *Zeitschrift fuer Transportwesen and Strassenbau*, consists in substance of a horizontal cast-iron disk of about 31 inches diameter, which is driven by a bevel gear making 22 revolutions per minute. The revolutions are registered by an apparatus in connection with it, which strikes a gong at the completion of each twenty-second revolution. Then ¾ ounce of powdered Naxos powdered pumice is spread on the disk immediately in front of testing-piece in such a way that the whole amount of powder must pass the sample. This is pressed against the disk by a one-armed lever weighted with 66 pounds, so that a smooth surface of nearly 8 square inches is exposed to the grinding process. After 110 rev-

olutions are completed, motion is suspended and the previously weighed testing piece, after being carefully dusted with a brush, is weighed over again. Then the sum of the different losses by wear, divided by the specific weight of the respective material, will give the amount of wear in cubic centimeters.

UNIQUE MONUMENTS.

"IN nearly every cemetery of any importance," remarked a well-known vault and monument builder to a New York *Commercial Advertiser* man, "there are two or three memorials to the departed that are eccentric in design and remarkable in construction. Strange to say, they are invariably erected by women, who seem to think they are honoring the deceased by embalming his or her principal characteristics in stone or marble. One of the most prominent examples of this peculiarity can be found down on Staten Island. Some time ago, a well-known broker died suddenly at his country place from over-exercise. His reigning passion during life was love of athletic sports, and he himself was a frequent prize-winner in various amateur contests. After he had been laid at rest, his widow went to a New York architect, and submitted one of the most remarkable ideas for a mausoleum that ever emanated from a human brain. It was to be built of white marble, and every variety of gymnasium implements, from dumb bells to Indian clubs, was to be reproduced upon it in bas-relief. Despite the objections of the other relatives that mausoleum was erected, and fills the visitors to the graveyard wherein it stands, with awe and wonder. In one of the Boston cemeteries there is a reproduction of an old-time whaling vessel done in stone and iron work, which was placed over the remains of a departed sea captain by his sorrowing relict. A granite tile tops the grave of a St. Louis hatter, and a pair of marble boxing gloves adorn the tomb of an old-time New Orleans prize-fighter. The oddest monument that I have ever seen personally, stands in the church of St. Xavier's, London. It has been there for 200 years, and preserves the memory of a certain Dr. Taylor, who was famous for his pills. It represents that gentleman in a reclining attitude with an expression of deep reflection on his features, and in one hand he holds a scroll bearing a most enthusiastic eulogy of the pills before mentioned. As it stands near the pulpit where the congregation could not help seeing it, it must have been a very valuable advertisement for the doctor's successors."

A ROCKING STONE.

THERE is a rocking stone in Bronx Park, says the New York *Sun*, that is worth looking at. To reach it the best way is, perhaps, to go out on the horse cars of the West Farms line, getting off at the lower end of the reservation, for it does not look much like a park just there at present, and following the road that enters it for a quarter of a mile or thereabout, when the stone will be plainly seen on a rise of ground to the left. It is a sturdy bowlder with a rough measurement of something like 10 feet by 8 in length and breadth, and a height that will average not far from six feet, one jag of it having an altitude of about 7 feet. The material is of quartz with a little mica and feldspar in it, no such amount as is found in the gneiss and coarse granite of the neighborhood, so it is obviously not related to them. In spite of the lichen and the weathering, it is evident that the bowlder was once white. It would pass for a pretty good lump of stone anywhere, in a region where bowlders were not too numerous and formidable—there are a few in the White Mountains and on Long Island that beat it—but it is seldom that one finds a stone that stands on a point so nicely adjusted as this, for it can be moved by a single hand. Though it weighs about fifteen tons it can be rocked by a man of ordinary strength, or by a couple of enterprising boys. A party of excursionists of a scientific tendency visited it the other day, and it was then moved without difficulty with half a dozen boys sitting on its top. The width of its swing is not conspicuous, however, and would not be seen across the field. It is perhaps three inches.

In order to swing at all it has to rest on a point, on a bed of solid stone, and while this point is rather blunt, it suffices to give it top-heaviness without imperiling its stability. Its platform is a smooth expanse of gneiss, such as is characteristic of the upper part of Manhattan Island and the hills for some distance to the north of it. It is apparent to the careless observer that the swinging stone does not have any relation to that which it stands on. How, then, did it get there? It came down in the ice, thousands of years ago. It is a part of the drift of the vast glacier that overwhelmed all of North America above us, and that went grinding and tearing its way southward, breaking off the tops of the hills along its route and paring down what were the noblest mountains in the northern half of our continent—the Laurentians, namely—to mere highlands of a thousand feet or so. This glacier, caused by the intense cold of a long series of winters, that, in turn,

were due to perturbations in the earth's orbit, rested part of its foot on the site of the New York City Hall less than a hundred thousand years ago. What kind of a country it was around here just before the ice got in, the geologists are trying to find out, but it is almost certain that there were men here, and if the supposed discovery of stone coins and statuettes in the glacial drift of Brooklyn count for anything, there were men not far behind those of the beginning of the Christian era in intelligence. The earth and sand and bowlders that the ice stream tore and wore from the mountains it dumped into the sea at this point, for Long Island is the terminal moraine of the glacier, and the coast line, that is denoted in shallow water for a few miles out to sea, drops suddenly into deep water at the point where the ice came to an end.

The rocking stone may have come down from the Hudson Highlands, or the Adirondacks, or the almost obliterated Laurentians. It may have been bedded in the frozen mass that moved southward at the rate of a foot or two a day, or it may be the mere kernel of a huge block that was rubbed along the rocks in the resistless march of the glacier. The ice that encompassed it, and that had an under surface that cut like a lapidary's wheel, smoothed the gneiss pedestal that it stands on, though it has long since been roughened by the elements and overlaid with vegetable mold, so that the old scratches like those found near Boston in the drift, and on the Catskills, and the Palisades in the solid rock have disappeared. It is a firm ledge of gneiss, thinly sprinkled with garnets, one or two large ones being imbedded near the rocking stone. Other evidences of ice action are found in Central Park, where the ledges are rounded into "sheep backs." Respectable hills may have stood here once.

In Europe the carrying power of the ice has been illustrated in many ways. One bowlder was traced to its parent mountain in Norway, 600 miles to the northward. The geologist Dana, mentions a European bowlder, but does not give its locality, that is as large as a good-sized house, a stone measuring 40 by 50 by 100 feet. Bradford, Mass., has one of 1,250 tons. These bowlders crossed hills and mountains without regard to their slope and steepness, and out of the millions of them that have been scattered over the land, it is perhaps, not surprising that a few here and there should have lodged in such a position that they may be moved without upsetting. The rocking stone near Pigeon Cove, Mass., is one of the most delicately adjusted in the country. The one in the Garden of the Gods, near Manitou, Colo., that looks like a top spinning, is not a glacial product, but owes its shape and its balance to the crumbling away of sandstone that forms its base.

There is a famous counterpart of the Bronx curiosity in Trereen Dinas, Cornwall, Eng., where it is known as the "logan stone," or "lodging stone." A British revenue officer forced it from its base in the early part of this

century in order to disprove a local superstition that it could never be moved except by supernatural means. The lieutenant used crowbars. He showed that it could be upset, to be sure, but the people of the surrounding country were so angry about it that the Lords of the Admiralty were constrained to advance enough money to rig an apparatus, hire men, and have it set in place again. It was believed that children could be cured of certain diseases by putting them on the logan stone and rocking them, but after the stone had been tipped over the charm was broken and has never been restored. Mason, in the old tragedy of "Caractacus," refers to the stone:

> Behold yon huge
> And unhewn sphere of living adamant,
> Which, poised by magic, rests its central weight
> On yonder pointed rock. Firm as it seems to stand,
> Such is the strange and virtuous property.
> It moves, obsequious, to the gentlest touch
> Of him whose breath is pure; but, to a traitor,
> Though even a giant's prowess nerved his arm,
> It stands as fixed as Snowdon.

With respect to the bowlder in Bronx Park, it does not seem necessary to have a certificate from a Sunday-school in order to move it. An Alderman tipped it once.

LARGE BLOCK OF ASPHALTUM.

THERE was recently transported from the mine of the Santa Barbara Asphalt Co. of La Patera, California, a large block of asphaltum weighing as it was taken from the mine, some two and one-half tons, and believed to be the largest block of asphaltum ever mined in one mass. The mine in question has only been opened about one year. Though chiefly used, as is well-known, for street paving, its employment is increasing for other purposes, large quantities being now consumed in making floors for warehouses, cellars, wineries, breweries, etc., as it renders floors absolutely water-tight, besides being affected by acids or gases. For lining dams, levees, and reservoirs, a thin coat of the article put on in a melted state presents a permanent water-tight surface, preventing loss by seepage, even when backed by only an earth embankment. It is claimed to make conduits of wood almost if not quite as durable as iron.

A GREAT MARBLE CAVE.

THERE is in the deepest fastnesses of the Ozark mountains, eighteen miles southeast of Galena, Mo., what is, perhaps, the greatest and most wonderful formation in the world. The famous Mammoth Cave, of Kentucky, has long been looked upon as the greatest marvel of the kind in the world, but its greatest depth is only nine miles from the entrance. Hidden away in the Ozarks is a cavern which extends over thirty miles, and has ramifications which, when fully explored, will undoubtedly show cavernous chambers and openings extending more than three hundred miles.

The existence of this cave has been known for about ten years, and its position makes it so difficult of access that no exploration has ever been made which will tell of half of the wonders to be seen in the underground palace. The interior of the cave is lined throughout with the purest white marble and variegated onyx. Stalagmites and stalactites adorn the walls and tops and bottom of these magnificent rooms, with fantastic forms and odd shapes which give to the whole an air of some olden palace. These formations are of all shades, from the purest translucent pearl to the dead white of marble and the striped blacks and browns of onyx.

Occasionally has come from Stone county to the outer world some tale of the wonderful marble cave, and these stories were of such fantastic depiction that they were treated with disrespect, and the one who told his tale was received with an indulgent smile. So persistent, however, has become the story, always with the same strange conceit of formation, that it was determined to make an exploration of the cavern as fully as the nature of things would permit. An exploring party left Galena for the purpose of seeing those wonderful things so often talked about. It was with a feeling of awe that the party returned to tell of the beauties and wonders of that mighty cavern.

Deep in the heart of Wilderness ridge, the highest peak of that highest ridge of the Ozark mountains is Roark peak. On the extreme summit of this elevated peak is an immense, crater-like depression, extending almost perpendicularly down for a distance of two hundred feet into an amphitheater, in the center of which is a narrow, slit-like opening. To reach this opening a hundred or more steps have been cut in the steep side of the crater, and then the explorer sees at his feet a yawning abyss extending down into the deepest darkness. Descent is made into this abysmal depth by means of a

series of rope ladders, and going deeper and deeper, at last he finds himself at the bottom, one hundred and fifty feet from the entrance, on a level floor, and can just see the daylight streaming through the opening far above him.

Now, as the eye becomes accustomed to the darkness, and the feeble light of the torches penetrate dimly the recesses of the cavern, it is found that the entrance leads directly into a most magnificent chamber. Magnificent both as to size and decoration. This grand amphitheater is almost circular in form, 700 feet in diameter, while the ceiling, 225 feet above, appears to be held in place by immense columns of onyx and marble. On all sides are to be seen exquisite forms standing against the immense walls as if carved by the hand of an artist, and the imagination can depict the varied forms of sculpture as seen in the galleries of the old world.

Some of these rival in massiveness and splendor the heroic statues of the world, while others bear all the delicacy of carving of the flowers which adorn the entrance of the cavern. Giant columns rear their heads to the roof, their bases standing on pedestals of incrusted marble and jasper. Intertwining among these majestic columns can be seen delicate tendril-like veinings which appear to be some beautiful vine suddenly turned to stone. Athwart the walls, crossing and recrossing, can be seen what at first glance appear to be bunches of beautiful flowers, showing all the varied tints of the rainbow, but which examination shows to be delicate incrustations across the chalcedony and onyx, forming tendrils and leaves as perfect as if formed by the hand of nature in the flora of the upper air.

Here, amid silence profound, the explorer is lost in wonder and amazement, and this scene alone repays well all the labor of reaching the spot. But there are more and grander beauties to be seen in this gigantic cavern of the Ozarks. From the grand amphitheater there extends five immense galleries, leading to other chambers which equal, and in some instances surpass, the first great room at the foot of the descent. From an opening off to one side there trickles a little stream of water so cold that it is as if it came from an iceberg. Following this to its source the explorer reaches the spring room, the walls of which are as white as pure jasper can make them. Here the temperature is constantly at 42° Fahrenheit, and the moisture which is in the air of the larger rooms and passageways condenses on the alabaster walls and trickles constantly down in streams which form the rivulet which runs into the grand amphitheater. The condensation of itself is one of the most remarkable curiosities of the immense cavern. So great is the supply that it is estimated that twenty gallons per minute pours off the walls of the small, barrel-shaped niche, called the shower bath-room, and runs down into the circular spring of Youth. This water is so pure that it leaves no deposit whatever, and is really distilled by nature just as it is by science above ground. This shower bath-room and spring-room

rivals in beauty of design any chamber decorated by art in the known world. Delicate veinings of onyx, alabaster, chalcedony and beryl interlace in such profusion one of the marble walls, and with such delicate tracery that the whole represents a picture of rarest design. Along the base of the room runs a dado of reds and grays, formed by the mottled and discolored marbles which have received the drippings of water, washing over portions stained with iron.

Leading off in another direction from the Grand Amphitheater is a lofty passageway, with stuccoed roof and arched entrance. Following this the Throne-room is reached and here in solitude is a grander throne than was ever built by man or designed by human brain. The Great White Throne stands alone in the middle of a magnificent chamber with lofty ceiling, full 300 feet above. From side to side the floor measures 200 feet. The Great White Throne, a majestic ovate stalagmite, stands in the center, formed of pure onyx and jasper with markings of chalcedony and beryl. Standing 36 feet across and 26 feet from front to back, it arises in grandeur to a hight of 65 feet, being 12 feet in diameter at the top. It looks like the crystallized ideal of perfection in the way of building, and is a picture of stately elegance and beauty. An immense niche faces the entrance to the room, and here is the imaginary seat of some prehistoric deity. The structure is hollow in its formation, and beneath the seat are three beautiful rooms of alabaster whiteness. No work of art can compare with it, and words are inadequate to fully describe its beauties and wonderful construction.

To the right of the immense throne rises to the ceiling a pure white, fluted pillar, about three feet in diameter, resting on a pedestal or base hollowed out into a beautiful room, the walls of which are of solid onyx, in colors of red, yellow and white. From this room flows a small stream fed from a spring which furnishes pure, ice-cold water.

On all sides of the throne-room the walls are adorned with flowers and vines carved by nature from the solid marble, while the yellow, red and white stalagmites stand on all sides, and beautiful pendants hang from the ceiling. Many and various are the decorations which adorn this most magnificent of all underground chambers; and yet there is more to be found by following the various passageways leading in all directions from the central portion of the cavern. Rooms spread out at the end of beautifully arched passageways and these are adorned with the same colored and white carvings. One passageway has been traced for a distance of twelve miles in a southwesterly direction, and as there is a flow of air coming from the interior, it is believed that this passageway connects with the famous Barry county cave, thirty-five miles away. That there is some other exterior opening is evidenced by the presence of remains of many animals which have undoubtedly wandered into these deep recesses and died. Nor is the immense

cavern uninhabited. It has a flora and fauna peculiar to itself, and like the walls, the plants and animals are pure white. In the Grand Amphitheater is to be found a peculiar plant, or fungus, blanched white by the darkness, and in the passageways are found a species of newt which is as white and colorless as the deep-water fishes. In the long passageways leading toward the Barry county entrance were found bats which had evidently found their way into these deep recesses. Some of these were of enormous size and had the appearance of the South American vampires.

In a body of red clay which almost choked up one of the passages was found an accumulation of bones of wild animals which had died in the cavern. Here are found bones of bears, wolves, deer, raccoons, foxes and numerous others, showing that at one time this was a veritable charnel-house for wild beasts.

Arrangements are now making for a complete exploration, which will be made in the near future; and while the place is now difficult of access and far from the usual resorts of men, within a few years the Marble cave of Missouri will be a formidable rival to the Mammoth cave of Kentucky.

"We have overlooked your order blank but we have not forgotten STONE, which we need in our business."—*The Southern Marble Co., Marble Hill, Georgia.*

THE PELTON WHEEL.

THE LARGEST WATER-WHEEL IN THE WORLD.

THE wheel illustrated on the opposite page is of the type commonly known as the overshot, or gravity wheel, and is unquestionably the largest and most expensive water-wheel ever constructed. It is located at Laxey, on the Isle of Man, a small island in the Irish Sea, off the west coast of England.

This wheel is 72 feet 6 inches in diameter, and is supposed to develop about 150 horse power, which is transmitted several hundred feet by means of wooden-trussed rods having supports at regular intervals, to the bottom of which are attached small wheels running on iron ways, for the purpose of lessening friction. The power thus transmitted operates a system of pumps in a lead mine, the duty of which is raising 250 gallons of water per minute an elevation of 1,200 feet. The water is brought some distance to the wheel in an underground conduit, and is carried up the masonry tower by pressure, flowing over the top into the buckets.

This great wheel was constructed some 40 years ago, and is said to have been running continuously during all this time. It is the great attraction of the place, hundreds of visitors making the trip to the Island every year to see it.

The little cut in the upper corner represents a Pelton wheel made by the Pelton Water Wheel Co., of San Francisco, through whose courtesy we sesured the illustration herewith, and is of corresponding capacity under similar conditions of head and water supply, being drawn to the same scale. The extraordinary results obtained from this well-known wheel are due to the peculiar shape of the buckets into which the water is directed from one or more nozzles, so that the full energy due to its head or fall is transferred into the inertia of the wheel. The power represented by the force of the water is thus converted into mechanical movement almost entirely without friction, the buckets simply taking the energy out of the stream and leaving the water inert under the wheel.

The efficiency of the Laxey wheel—taking resistance into account—it is estimated cannot be more than 65 per cent. of the theoretical power, while the Pelton will develop fully 20 per cent. more, and in size and appearance is a mere toy as compared to the ponderous piece of machinery shown, with its massive column, arches and stone foundations.

The most striking contrast, however, will be seen in the item of cost, which is so much less as to make a comparison almost absurd. While no data is at hand in regard to this, it is apparent that it would be at least as one to fifty in favor of the Pelton. Such an object lesson is of value in showing the wonderful progress in engineering practice during the half century, in bringing the forces of nature into subjection, making them subservient to commercial and industrial purposes.

NOTES ON QUARRYING.

ROCK-BLASTING BY ELECTRICITY.

IN some instances it is found desirable to discharge several hundred, or even several thousand holes simultaneously. These cases are rare, and heretofore involved the construction of special batteries. Since the introduction of the electric light about mining operations it has frequently been suggested that the light wires be used for blasting. In the case of a large blast there is nothing better for the purpose, and we have no doubt that another Hell Gate blast might be made with better success and at less expense by simply using the current from the dynamo.

In ordinary blasting operations it is not advisable to use the electric-light current for blasting. There must be more or less danger connected with its use, and it is well to eliminate absolutely the blasting of rock from any connection or association with the electric-light wire. A case has, however, come under my notice where the electric-light wires are used with safety and success. I cannot but attribute this to the skill and care of the superintendent of the mine, Mr. J. A. Van Mater. The mine referred to is that of the Sterling Iron and Zinc Co., Franklin Furnace, N. J. A sketch is appended showing Mr. Van Mater's arrangement, and it at once appears extremely simple. A switch circuit is taken from the main line and five 16 candle-power incandescent lamps of 109 volts each are cut in. The object of this is to reduce the strength of the current. The wires are carried down the shaft where they are connected to the wires of the exploders in the same manner as though connected to a blasting battery.

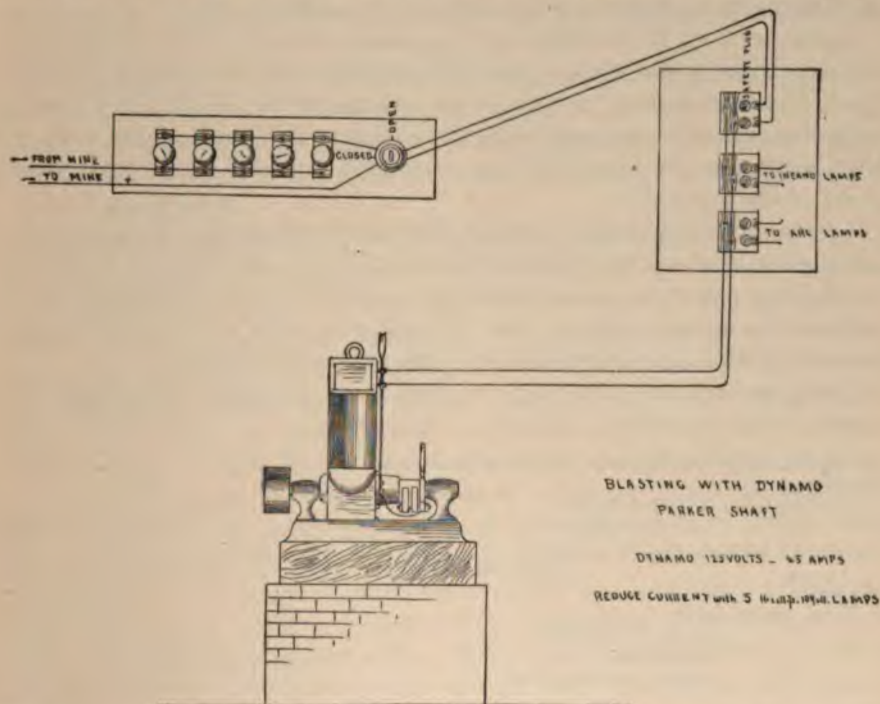
This plant consists of an Edison dynamo of 125 volts, 5 Kilowatts, *i. e.*, 90 lamps of 16-candle-power. Two are lamps of 1,200-candle-power each are used, equal to about thirty 16-candle-power incandescent. Altogether fifty-four 16-candle-power lamps are used out of an available 90-candle-power, so that there is a large reserve capacity.

The switch shown in the sketch is always left open, but in order to insure perfect safety the plug marked "Safety Plug" on sketch is always taken out and put away in a little drawer in Mr. Van Mater's office. If any one should go into the engine house and turn the switch while the blast is being connected in the mine it would not be possible to explode the charge. When ready for blasting, which in this case is determined by a count regularly made by

the shift boss of all his men, the engineer puts in the safety plug, turns the one-quarter turn and the blast is made.

At first only four incandescent lamps were put in the circuit to reduce the current, but it was found that the connecting wire in the mine was fused by too great a current. This was because connecting wire commonly furnished with exploders is small in diameter and offers so much resistance in the passage of a current. An additional lamp was cut in and no further trouble was experienced.

Though the greatest number of holes fired in the shaft by this plant is 12, yet it is evident that there is current enough in their line to fire



several hundred. A test was made with 40 caps and all went off simultaneously. This blasting arrangement has been in use several months and no misfires have occurred. Double strength, double insulated exploders are used. Before this plan was adopted a good deal of trouble was experienced owing largely to the fact that the shaft is very wet.

Mr. Van Mater suggests a separate circuit from the dynamo, that is, not the same circuit that lights up the mine. But this is very easily accomplished and is quite inexpensive.

Another point of interest about Mr. Van Mater's work, at this shaft is that

notwithstanding many difficulties they are sinking in a shaft 10 feet wide and 20 feet long, taking out 8-foot cuts, or 132 cubic feet of solid rock with 129 pounds of 60 per cent. Forcite powder, or a little less than one pound of powder to one cubic foot of rock broken. This, of course, is very much higher than the record made in tunneling and open cut work, but it is well known among experienced persons that shaft sinking is not only the most difficult, but the most expensive kind of rock excavation, submarine work only being excepted and that in rare instances.

Rock excavation is by no means so costly as it was a few years since. Improvements have been made in the machinery for drilling, in the methods of blasting, in explosives, and in transportation machinery.

Open cut work in limestone rock is, perhaps, the cheapest. Even in open cut work in New York rock contracts are now let for less than $1 per cubic yard. A recent letting of more than 100,000 yards of New York rock was made to responsible contractors at 75 cents per cubic yard. This work is in high bluffs and it is likely that the contractor expects a profit from the disposal of the material.

I have recently procured reliable figures based on ore bank blasting at the Croton Magnetic Iron Mines, Brewster, N. Y. Mr. Charles Vivian who did the work by contract is known to be competent and reliable. He is a self-made contractor, and is one of those men who controls and manages his own work. In other words he is always on the ground.

Quantity and cost of mining at the Croton Magnetic Iron Mines from July 13, 1891, to Jan. 5, 1892.

Total number of cubic yards ore and rock mined	9,295
Drilling.	
Total number of holes drilled	238
" feet drilled	2,988
Average number of feet per hole	12½
" cubic yard	$\frac{32}{100}$
Expense.	
Total cost of labor	$5,696.00
" steam for drilling	212 13
" explosives	755.35
" repairs and supplies	139.00
	$6802.48
Explosives.	
Total number of pounds dynamite used	4,083
Average per cent. of oil used	52
Average number of pounds per cubic yard	$\frac{44}{100}$
Tötal cost per cubic yard.	
Labor	$61.28
Steam for drilling	2.28
Explosives	8.12
Repairs and Supplies	1.50
	$73.18

This ore was mined and broken to seven inch cubes and the waste rock

to about ten inch cubes. The foregoing price includes loading on cars at the breast.

It is certainly an evidence of advance in rock excavating appliances that we may show a reliable case where ore was mined and broken to small pieces at $73\frac{16}{100}$ cents per cubic yard the price including all expenses connected with the work such as drilling, powder, block holing, sledging, blacksmithing, repairs and supplies, and loading in cars. Most of this ore was broken when thrown from place, but a small block holing drill was used for breaking up the large pieces.

In the government work on the Harlem river the contractors are paid 93 cents per cubic yard for rock above the water line, and I have been informed by one of the contractors that it has cost them 40 cents to drill blast and throw it.

In a general way it may be said that open cut rock work costs from 3 to 10 cents per cubic yard for drilling and from 15 to 30 cents per cubic yard for labor of blasting and explosives. These figures are based on drilling and blasting only and under fair conditions. The rock is simply thrown at the foot of the bluff.

It sometimes costs more to waste the rock, that is to get rid of it, than it does to dislodge it. The location of the dump has a great deal to do with the cost of moving the rock. A dump close at hand and at a down grade is the most favorable. Where the conditions will admit a steam shovel is an economical device for removing rock. In order to use steam shovels the rock must be of such a nature that it will break readily and in small pieces, and the work must be uniform and continuous, like that of a railway or canal excavation. The delay caused by moving a steam shovel to get it out of the way of a blast is a serious obstacle to its use. In work where the bluff is steep and the drilling extensive it is seldom necessary to blast more than once a day, and after the blast a large mass of broken stone is thrown a considerable distance in front of the bluff, and in such work as this the steam shovel may work to advantage, as it may have a whole day's work ahead, or without moving backward. The use of the steam-shovel, of course involves the use of cars, and it can only be used where there is plenty of track room.

For extensive open cut-work where a steam-shovel cannot be used, the most economical device for handling the stone is the cable hoist. This hoist is of so much value and has recently been a subject of so many improvements that it deserves more than a passing notice.

Fig. 1 is an illustration of an improved form of horizontal cable-way. It will be observed that two A frames or towers are located on the banks of the mine or pit. These towers are usually about 500 feet apart and serve to support a main cable whose ends are securely anchored to the ground.

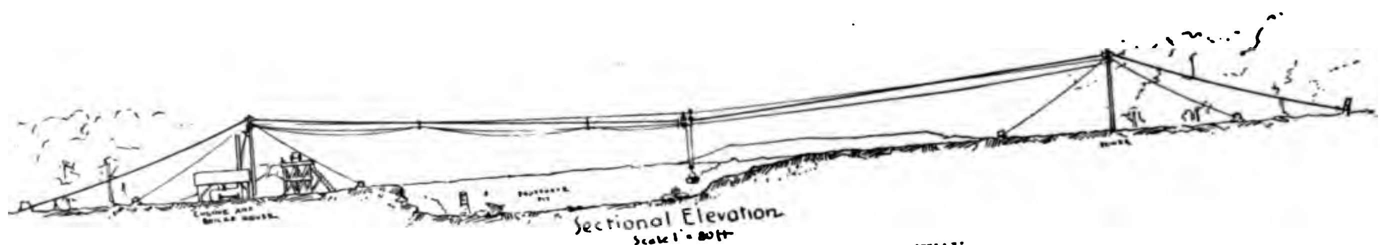


FIG. 1—THE LOCKE-MILLER HORIZONTAL CABLEWAY.

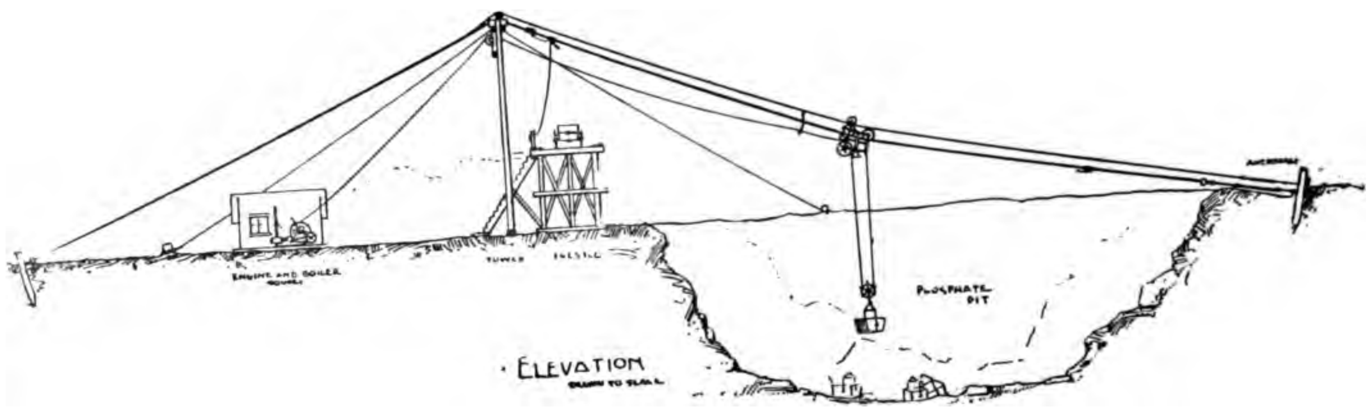


FIG. 2—THE HARRIS-MILLER INCLINE CABLEWAY.

The cable is a track-way for supporting a traveling carriage from which is suspended the hoisting rope. Two moving ropes are employed, one known as the hoisting rope and the other for the purpose of giving the horizontal movement to the carriage and known as the endless rope.

Fig. 2 is known as the inclined cableway and has been extensively used in slate quarries and in open cut mining. It will be observed that the incline cableway has only one tower, the other end of the cable being fixed in the bank. The incline cable is, of course, cheaper than the other, and it serves the purpose very well where the work will admit. It is not universal in its application and is not so thoroughly under the control of the engineer as the other form. Stops are placed on the cable at certain points where it is desired to have the carriage stopped in order to take a load.

Many improvements have been made in the details of the cable hoist, principally in the traveler of hoisting appliances. Good engineering is required in its construction. The largest span which has been used is that built by the Lidgerwood Company for the Austin Dam, at Austin, Tex., this dam being 1,350 feet long, carrying capacity 6½ tons per trip. Another long span, 1,200 feet, is in use at the Edison Concentrating Works, at Ogden, N. J. The most important and largest application of the inclined cableway is at the Tilly Foster Iron Mines in New York, where 60,000 tons of ore has been handled with these cables.

The following is the cost of transporting material at Beaver Asbestos Company mines, Thetford, Quebec, where a cable hoist was used. In this work the carrier makes 300 trips in 10½ hours, or one load every two minutes, each load averaging 1¾ tons, or a total of about 500 tons.

Labor Force.	
One engine man	$ 1.50
Two truckmen, $1 each	2.00
One tag rope boy	.50
Nine muckers, at $1.25 each	11.25
	$15.25
Fuel.	
One and one-half cord wood	.75
Oil, etc.	.25
Total	$16.25

Based on 500 tons this is about 3.2 cents per ton. This includes raising from the pit and delivering at end of dump 350 feet from foot of derrick.

Incline of cableway 30 degrees, 225 feet long. Pit 40 feet deep.

Wm. L. Saunders.

PROSPEROUS STONE PRODUCERS.

PROMINENT among the successful firms of the Bedford, Ind., district is that of Perry, Matthews & Buskirk, the personnel of which is as follows: W. N. Matthews, Frederick Matthews, H. F. Perry, G. K. Perry, S. E. Matthews and P. K. Buskirk. Their quarry, an illustration of which appears above, is located five miles north of Bedford, and was opened in 1889, the possessions of the firm at that time consisting simply of one derrick and a channeling machine. They now have three derricks, six channeling machines and three steam drills, together with other improved quarrying machinery and tools.

The stripping is comparatively light considering the depth of good stone, which is from 40 to 60 feet. About 100 men are employed at the quarry, and they succeed in getting out from six to ten car loads per day. That which requires sawing is loaded on flat cars at the quarry and shipped to the steam saw mills of the firm at Ellettsville.

The stone quarried by this firm is of the genuine oolitic variety, presenting a handsome creamy appearance, gradually whitening with age. It is of almost unprecedented purity, containing an average of 96.8 per cent. of car-

bonate of lime, hence is not affected by decay in an atmosphere charged with the gases of burning coal. As it comes from the quarry it is so soft as to be readily worked by saw, chisel or planing machine, while on exposure it hardens to a strength of from 10,000 to 12,000 pounds to the square inch. Ready for the mason or sculptor, it is alive and resonant, answering with a clear, metallic ring each touch or blow. This resonancy is an excellent test of the perfect unity of its particles and as a result it is highly elastic, enabling it to adapt itself to the effects of a changeable climate. Its color is of the same uniformity as its texture and its popularity as a building stone is evidenced by the fact of its having entered into the construction of the following beautiful buildings: Library of the State University at Bloomington, Ind.; Levi Z. Leiter's residence at Washington; the New York Store building at Indianapolis; government building at Springfield, Mo., and various other noted buildings in all of the large cities east and west.

The general office of the company is located at Bedford, with W. N. Matthews in charge. Mr. Matthews has been in the stone business since a boy, barring the period of his service to the country as a soldier. At the meeting of the quarry-owners held in Chicago, last February, for the purpose of permanently organizing a national association of quarry-owners, his services were enlisted in the preparation of a constitution and by-laws, which was at once approved by those present. He was also selected as one of three men to enforce resolutions adopted by the organization for the suppression of unfair dealing on the part of dealers and agents. The other offices of the firm are located as follows: New York City, Potter Building, A. Marine, agent; Philadelphia, 3201 Walnut St., Garrett & Dix, agents; Chicago, 708 Tacoma Building, Nicholl & Witty, agents.

MOVING TO MAINE.

FOR some time past negotiations have been pending with the Burpee Granite Company for the location of their works in Calais. Under the change in our tariff laws this company found that it could operate to much better advantage in this country than to remain in the Dominion and pay the increased duty on the product of their quarries. The enterprising citizens of Calais at once opened negotiations for the location of the plant there. A committee was raised to visit the quarry and make a general investigation of the value of the plant. We learn from a Calais paper that it is now assured that the works will be locatad in that city and the company will be organized at once. One of the conditions was that the citizens should subscribe $10,000 to the capital stock and this it is stated has nearly all been taken.—*Rockland, Me., Gazette.*

BLARNEY-STONE KISSING MADE EASY.

I WENT out upon the usual pilgrimage to pay my respects to the Blarney stone. Formerly the kissing of this magical piece of rock was done at risk of life. The stone is in the lower course of the parapet of the great tower. The parapet is about three feet out from the wall of the tower, this convenient space being left by the old builders with a view to hurling stones and arrows and boiling oil upon the heads of unwelcome visitors. The stone, being in the lower course of masonry, is not only thus removed three feet out from the wall on which you stand, but is about the same distance below the top of the wall. So that the old way of getting at it was to lie down on top of the wall and get somebody of good weight to sit on your legs, and so get your head out and down to the right spot for the payment of this mystic and painful osculation.

But to-day anybody can kiss the stone of Blarney. They have set a series of iron bars between the stone and the wall, making a sort of open floor. You step down on that, and get down upon your knees, and the deed is done. Henceforth your tongue is gifted with a new possibility of speech, as if you dined every day upon honey and butter. It is now impossible for you to say mean things about your neighbor. You speak hereafter in the delightful dialect of "blarney"—unless the new ease and comfort with which the stone is kissed have dispelled its ancient benediction!—*Pittsburg Dispatch*.

"We are much pleased with the remodeled and enlarged STONE. We consider it the best magazine of its kind now published."—*Tennessee Producers' Marble Co.*

COMING AGE OF MARBLE.

"THE next twenty-five years is to be an age of marble," said an architect. He spoke especially of the interior finish of buildings. Not only for its beauty, but also on the score of cleanliness and durability it is the best of all materials which can be used for interior decoration. The variety of colors is so great that almost any desired effect can be obtained. White, black, green, gray, red, blue and yellow, in many tints and combinations, are all ready to the hand of the marble worker. And the cost of marble is very little more than that of hard wood, if the latter is to be well finished and well cared for.

In comparing cost of hard wood and marble the durability of the latter material is too often lost sight of. If wood is to be kept in good condition it is a constant source of expense. With marble the first cost is the only cost. Well-polished marble, when used for interior decoration, is practically imperishable, and is always bright and clean. Too often, also, the reduc-

tion in cost of production which has been effected in recent years is forgotten. Not very long ago "marble halls" were supposed to entail the most extravagant expenditure. Modern machinery and methods of working have changed all that. But the revolution which has taken place is only half appreciated.

Take, for instance, the mere cost of transit from foreign countries as compared with the cost of this same item only five and twenty years ago. It may surprise some people to know that it costs less to transport marble from Carrara to London than it does to carry it from Carrara to Rome. It causes no astonishment to find that marble is lavishly employed in Italian buildings. "Of course the material is raised in the country," says the observer. But Italian marble can be delivered into English ports at a less cost than it can be sent into many Italian towns. It is a want of knowledge of this fact which has often stood in the way of the employment of marble in English buildings.

"The colors of marble," says John Ruskin, "are mingled for us just as if on a prepared palette. They are of all shades and hues (except bad ones), some being united and even, some broken, mixed, and interrupted, in order to supply as far as possible the want of the painter's power of breaking and mingling the color with the brush. But it will be said it is too expensive to employ real marbles in ordinary cases. It may be so; yet not always more expensive than the fitting windows with enormous plate-glass and decorating them with elaborate stucco moulding, and other useless sources of expenditure in modern buildings; nay, not always in the end more expensive than the frequent repainting of the dingy pillars, when a little water dashed against them would refresh from day to day if they were real stone."—*Stonemason.*

A CURIOUS LANDMARK.

A CURIOUS and interesting landmark, but one that is not very well known, can be found at the Battery in this city. It is a flat piece of brownstone about eight inches square, with a five-cornered star cut on it, and it is set in the earth on a level with the sod, not far from the big flagstaff. This stone marks the spot where the famous old Liberty pole stood when the British evacuated New York City on November 25th, 1783, and was placed there many years ago without formal ceremony by some decendant of a patriot of 1776. There is no inscription upon it, and many people have formed the erroneous impression that the present flagstaff stands upon the historic spot. One of the last things the British did before leaving

the city, was to hoist their flag pole and then grease the pole so that it would be difficult to get the colors down. This was done, however, by David Van Arsdale, an American soldier, who climbed the pole and set the American colors flying, to the chagrin of the English fleet as it passed down the bay.—*Architecture and Building.*

THE ONEONTA SANDSTONE.

AT the meeting of geologists in Rochester, on Tuesday of this week, Prof. James Hall, of Albany, read a paper on the Oneonta sandstone, and its relations to the Portage, Chemung and Catskill group. He deplored the fact that two nomenclatures are in vogue, one founded on fossils and the other on rock foundation, and illustrated his remarks by diagrams and maps. This is a subject to which Prof. Hall has been paying much attention for the last twenty years, and the results he has arrived at are exceedingly curious and interesting. But it is an old battle ground of geologists, and his observations and theories were not permitted to go unchallenged. Prof. Stevenson and Prof. White took part in a discussion of Prof. Hall's paper, and expressed somewhat different views concerning the Chemung and Catskill formations. The Rochester *Union* says it was the general consensus of opinion among the geologists present, that the Oneonta and Portage region is the most interesting and important for geological study to be found on the continent.

THINKS "STONE" A MARVELOUS PRODUCTION.

IT will be a matter of astonishment to some of our readers if we claim that STONE, published in Indianapolis, Ind., and printed there, is the finest magazine that has come to hand this month. We speak of paper, print, make-up and general dress. The matter is mainly devoted to stone, masonry building, etc., with sections of technical matter. It is a creditable and even a marvelous production of the kind.—*Industry.*

LUDLOW, VERMONT, FROM THE NORTH.

LUDLOW AND PLYMOUTH.

THE list of Vermont towns having sufficient mineral wealth for valuable quarries has no end. The farther we look up and down the state the more we find, and if we could examine carefully each town we should undoubtedly find that the mineral resources were practically, limitless. In the June issue of STONE the story of Weathersfield was told and this month the story of Ludlow and Plymouth is written for the benefit of those who may have never heard of the existence of such places. The two are written together because they are really inseparable. Commercially they are one. Ludlow has the large village, the business center and the railroad, while Plymouth is made up of mountain farm land and mineral deposits.

To reach Ludlow one must go to Rutland, the great marble center of this country, and thence by rail over the Green Mountains a distance of thirty miles or so. Another way is to go to Bellows Falls and climb the Green Mountains from the other direction, a distance of twenty miles. In either case the traveler will go through some of the most beautiful scenery in Vermont. The road over which one must travel is the Rutland division of the Central Vermont. And the journey will repay one to make. As the train nears the village from the south one looks down upon the Black river meadows and on rounding a slight curve the village lies just below the track, stretching away to the hills on the other side of the valley, and nestling close under the side of Soltudus, a mountain which ought to be more famous for its beauty than it is.

Coming into town from Rutland one glides down the mountains from Mt. Holley over one of the steepest grades in the state, whisks across a high bridge under which runs the highway to Andover, another rough mountain town, and pulls up at the little brown station with the same magnificent panorama spread out at one's feet. The ride down the mountain is an uninterrupted succession of beauties. Here the train glides through a wood, and on emerging comes unexpectedly upon a farm house with a good broad farm spread out before the view. The next turn will reveal a mountain brook being dashed to foam over a precipice and so on, the constant succession of new beauties never ending, never varying until one almost wonders if there is no end to the surprises which nature is meting out to the traveler.

The train stops at the station and the traveler takes the coach and goes to

the new hotel, the Goddard, and is ushered into one of the cosiest houses in New England. It is but lately finished and is attractive in its outer appearance. The village itself is one of those mountain places which one finds in roaming about the hills of the Green Mountain state. It is huddled into a sort of irregular hollow, the Black river flowing through it, and its streets are irregularly laid out. Beautiful homes with broad lawns and shrubbery and flowers line both sides of the streets, for it is a village of homes such as are found only in New England. As one goes out farther the homes become more scattering and finally only elegant farm houses surrounded by numerous, well cultivated acres, are seen, reaching out to include the fine meadow land along the river.

In years past Ludlow has shared in the general depression of business which has seemed to rest so heavily upon Vermont. But now, all is different. For many years the Ludlow woolen mills were the largest business enterprise in town. Three thousand spindles were operated, thirty-eight looms and seven sets of cards, and the output was 150,000 yards of goods per year. The number of employes has been one hundred and fifty, or more. Now another woolen mill is building, which will do an even larger business and the output will be a great addition to the products of the town.

There are in addition a machine shop, the Ludlow toy manufactory, a tannery, sawmills, granite works, a freestone company formerly did a big business, but the output is now very small, though annually increasing, and the product includes both soapstone manufactures and scythe-stones, shingle and chair factory with several sawmills and lumber manufactories scattered about on the larger brooks and streams.

The combined output of these shops and mills is large, and the effect of such a combination of business is seen in the nice looking homes, the schools and churches, the nice farms in the immediate vicinity and all the other outward evidences which go to make up an excellent appearance for a typical New England village.

Among the new buildings erected within a year or over, is the woolen mills above mentioned, a nice Congregational church edifice, the Goddard House. All this is very attractive and pleasant, but that is not all to attract

the man or woman who wants a home in this state of all others which has the old Puritan characteristics most strongly marked.

The town is blessed by having within its borders one of the best academies in New England—Black River Academy—founded in 1834. A cut of the new building finished but a few years ago and dedicated on the commencement day of one of the most successful terms of the institution, is given herewith, and illustrates the beauties, architecturally, of the building. It stands on a commanding hight, and from its walls have gone forth men and women who have made their mark wherever they have taken up their life-work. United States Senator Proctor, late secretary of war, was educated there, Hon. Alanson W. Beard, collector of the port of Boston, and many more who are famous in history and story were students of this academy among the hills. To-day the academy stands with open doors inviting the East and the West to send their students to her and she will send them back with their very being permeated with the inspiration of New England and Puritan Vermont.

There are two printing offices in the village, R. S. Warner's job office, at which is published the *Enterprise*, a monthly paper which is enjoying a large circulation, and the *Tribune* office, where is published by E. C. Crane, one of the best weeklies in the state. The paper has an excellent field for circulation and is cultivating it. Mr. Crane also does job printing. It has been said that the intelligence of a community can be correctly gauged by the amount of printing and publishing done within its borders. That proposition, being assumed as correct, Ludlow has very great claims to consideration as a more than ordinarily intelligent community.

Readers of STONE will undoubtedly want to hear of the mineral resources and what the prospects might be for future development. It must be said that it is not so promising as in Weathersfield which was written of in the June issue of this magazine, but still there are fortunes to be dug out of the hills by the favorably disposed capitalists. In the eastern part of the township there is a lofty range of serpentine, containing the harder varieties of asbestos, and probably underneath the outer layer something of better quality. There are good deposits of pure talc, but whether it shades into the more valuable varieties it would be impossible to say. The prevailing rocks are, however, gneiss and talcose schist. In the northwestern part there is a good

ledge of quartz and serpentine, as has been mentioned, and steatite is very abundant in the eastern part. In the serpentine and steatite and around it are found beautiful specimens of the verd-antique marble, which seems to make this immediate region its special home. Gold exists in small quantities along Black river and its tributaries, and excellent specimens of iron ore abound in different localities. Building stone of various sorts is very plentiful and there are indications that the deposits above mentioned are even more valuable than would seem from a cursory examination.

Transportation facilities compare very favorably with other portions of Vermont. The Rutland railroad cuts the town in two, and the roads which lead to it are as good as the average. The town is on the upward turn now and there is a splendid opportunity offered for the development of any industry which a capitalist should see fit to establish. Such a capitalist will find that the inhabitants of the town will be pleased to see him and will favor him in every legitimate way.

The town is the center of a large farming community and the opportunity for those who wish to find good farms are becoming daily more scarce. But the manufacturer can safely assure his prospective operators that they will not be obliged to send to a distant state for food products, but can find the best at their doors. With this there is a cordial coöperation on the part of all agricultural producers to assist in the development of the village.

The summer boarder, or sojourner from the city, will find the high altitude, the pure water, the clear, bracing air which he seeks. The scenery, the hunting and the fishing are unsurpassed, while the chances to secure accommodation are unlimited. With this we leave Ludlow.

Plymouth, the sister town and connected with Ludlow by indissoluble business ties, is the wonder among all Vermont towns. Mother Nature, lavish in her mineral dispensations in this part of the country, was more than liberal with Plymouth, and seemed to have done up a mixed bundle of strange mineral opposites and dropped them while on her way over this town. Nowhere in all New England is there such a variety of mineral wealth, all valuable and rich in money producing power, and nowhere could the money of the capitalist be expended to better advantage.

If one were to say that Plymouth is an epitome of all geological formations he wouldn't be far from truth. Drift is very abundant. Terraces and lateral and terminal moraines are so numerous that they excite comparatively little interest after one has looked about the town awhile. Drift and glacier striæ abound everywhere and pot holes 342 feet above the present river bed, give evidences of the great erosion which has occurred during past ages. The tertiary deposits embrace brown hematite, kaolin, quartz sand, manganese and some other products of that period. Metamorphism can be studied to better advantage than in any other equal area in Vermont.

There is conglomerate with pebbles imbedded in a chloritic matrix, passing insensibly into talcose schist, the pebbles flattened as though softened by great heat, as they undoubtedly were, and subjected to enormous pressure. A mile or more from this bed there are what appear to be seams of quartz in talcose schist, but are really flattened quartz pebbles occurring in layers, which once helped to form the conglomerate from which the schist was formed by metaphorism.

There are beds of impure limestone formed into hematite and the weathered edges of other deposits show large quantities of oxide of iron, the material from which hematite is formed. Limestone is very abundant and some of it is sufficiently pure to be utilized as marble, taking an excellent polish. Plymouth white lime was formerly famous and might be again did anyone care to undertake its manufacture. There is a beautiful bed of mottled marble, in color blue and purple in different shades, which has no known counterpart excepting in Tuscany, and a large block from the Tuscan quarries now in the vatican at Rome might be replaced by a similar block from the Plymouth bed and none would notice the difference. Geologists have been divided on the composition of the stone, but the preponderance of opinion seems to be that it is formed of partially fused and flattened coral pebbles imbedded in the marble. A small sheet of this stone polished was one of the most beautiful objects the writer ever saw. The extent of the quarry cannot be stated, for careful examination was not bestowed upon it.

In iron ores Plymouth is rich. There are extensive beds of specular iron, and Mr. Tyson became wealthy smelting the ores into iron in the town forty years ago. The mines are now abandoned. The shafts are full of water, or have caved in. The buildings have been removed or rotted down, and nothing but the yawning pits and tunnels remain, as scars in the earth, to show what has been accomplished in the vicinity. Carbonate of iron is found in an immense bed in the southeast part of the town, and the ore makes excellent steel. The fracture of the ore shows glistening particles, much like the finest Bessemer steel. The bed is on the side of a hill and it is very difficult of transportation. A gravity road would overcome any difficulty which confronted the workers years ago.

Not alone iron, but gold is abundant. For many years Plymouth's gold mines have been pointed to as an example that gold does exist in paying quantities in New England, There is gold-bearing quartz, rich in places, and some valuable placer mines on Gold Brook. Only a few years ago a stamp mill was erected there, and for several months gold bricks aggregating $8,000 in value were made monthly. But alleged crookedness or mismanagement on the part of the agent made the work unprofitable and the diggings were abandoned.

There are rich deposits of soapstone, and valuable serpentine is plentiful,

some of the latter being particularly good. Both have been worked somewhat, but nothing is now done in either business. Granite exists in the form of boulders, handsome and fine grained, and in the ledge, but has never been worked at all. And to all this enormous quantities of choice building stone, sum up the whole, and one can gain some idea of the geological richness of Plymouth.

The general surface of the town is bold and rugged with numerous deeply eroded valleys and transverse gorges which render the scenery grand, beautiful and picturesque beyond description. In fact it is a veritable paradise for the geologist, and if one wants the history of the universe condensed into an exceedingly small place here is the locality to look for it.

Business opportunities are abundant, and the man who wants to undertake the production of anything made from stone can hardly fail to find what he desires among the Plymouth hills. The list, as has been given heretofore, is a long one and comprises most of the economical stone products known to commerce.

Plymouth is best known in later years for its gold diggings. The purity of the output exceeds that usually found in California. In 1855 a number of men who had worked in California became convinced that the rock formations were similar to those in which gold is found in that state. Acting upon this, they began prospecting in Vermont and in nearly all cases found the metal in encouraging quantities. About seven hundred dollars worth was taken out that season in the state, of which five hundred came from Plymouth. Dams were built, sluices were erected, and for a time the gold fever raged as highly as it did in California in the early days. On the whole, however, the diggings cannot be said to have proved prosperous that year. In the fall of 1858, William Hankerson, who had discovered the gold in 1855, began working a claim at the Five Corners with bright prospects of success. In a piece two rods square he took out about four hundred dollars, worth of gold, some in nuggets of considerable size.

An assay made November 9, 1855, shows the purity of the gold to be

Weight before melting	136 dwts.
Weight after melting	133 dwts.
Carats fine	23¼
Value per dwt.	.9955
Total value	$132.40

The gold of Vermont occurs in or near the beds of serpentine and soapstone, and none of value has ever been taken out east or west of that line. The largest lump ever found in Plymouth was valued at fourteen dollars and came from Reading Pond brook.

Taking up the deposits of iron ore we find an analysis of the Plymouth iron ore to be as follows:

Peroxide of iron	83.03
Silica	2.53
Water	14.50
Metallic iron	58.12

There is found green malachite or carbonate of copper inclosed in dolomite and chalybite or spathic iron mixed with pyrites and a small showing of manganese.

Near Tyson furnace, one of the postoffices in the town, is a large deposit of kaolin and white sand suitable for making porcelain. This has never been worked and is ready for the manufacturer who desires to invest money in the production of such fragile articles.

Great stress was laid upon the presence of limestone near the deposits of iron ore when the extensive beds in different parts of the South were opened a few years ago. That was just and proper, but it was hardly proper to let such rich deposits in one's own state go begging for recognition when the same was true here. Plymouth has one of the largest, if not the very largest bed of limestone east of the Green Mountains. The original bed is somewhat split, but there is no doubt about its being the same deposit, once one great bed. The town once furnished great quantities of limestone for commercial purposes and it was quarried to be used as a flux in smelting the iron ore when iron production was going on here. Now the largest quarries in the state are idle. It is six to seven miles to the railroad and other places nearer have taken away the value of the stone as a commercial factor.

The mottled marble would furnish good lime for whitewash for walls. The variegated marble is dolomite composed of

Carbonate of lime	53.9
Carbonate of magnesia	44.7
Oxide of iron and alumina	13

It takes a good polish and is only six miles from a railroad, situated on a road which is all down grade. The quarry was opened about 1840 and worked for a while, but white marble superseded it. It has produced excellent white lime known to the trade as Plymouth white lime. The atmospheric agencies of any climate have no effect upon it. There are spots in it which resemble fragments of branching coral and some geologists think that it is. The stone splits in all directions and is very easily quarried. The supply is inexhaustible. Prof. Hitchcock, of Dartmouth college, said that one thousand men might work upon the quarry for one hundred years without making any appreciable diminution of the supply.

In the southeastern part of the town are extensive soapstone beds, and outcrops are numerous. Further north are still others and there is apparently no limit to the riches in that direction. But the soapstone is similar to that found all over Vermont, on the eastern side of the mountains and no especial description is necessary. In fact, I consider that all the beds in

sixty towns are but outcroppings from what was once one huge deposit of soapstone, rent asunder by some mighty agency in the past.

There is kaolin under the hematite beds, manganese, pyrolusite, psilomelane and braunnite. Ochre beds are found in some places and a ferruginous limestone is found beneath and contiguous to these beds. In the south part of the town is a deposit of hematite which Isaac Tyson worked to some extent. Near it quartz-sand, kaolin and manganese are found. In driving a drift from the east, workmen found a bed of kaolin and quartz-sand five rods thick. Next came ochre, then hematite and manganese very plentiful. An analysis shows as follows:

Peroxide of iron	83.03
Silica	2.53
Water	14.50

Numerous other beds exist but none are so good as these.

The iron mines are but evidences of ruin now. The buildings and machinery are removed or fallen to ruin. The shafts and tunnels are fallen in or filled with water and rubbish. And yet there are grand opportunities. Ludlow, with its railroad, is but a few miles away. The Central Vermont company has always proved itself very liberal with prospective patrons and there is little question that the company would build a spur-track to these noble mineral deposits did the promise of development warrant it. They did it in the case of Barre and why should they not in this instance? That would solve the transportation question and unlock the vast resources of a wonderful town.

But not alone as a wealth producing town should Plymouth be mentioned. The scenery is superb. The source of Black river is a series of ponds which cannot be equaled in America for beauty of location or surroundings. There is nothing like it; should I attempt a description I should fail of my purpose, and I will not try it. There is too much to be said, and the traveler has only to visit the region to be convinced of the truth of my statements.

In the limestone formation along the Black river valley, in the eastern part of the town, is a series of caves which have no counterpart in New England. And so one might go on enumerating the wonderful natural beauties and richness, but space forbids. And I only invite the capitalist or the seeker for what is curious in nature to visit the locality and see for themselves. That will prove it; and when you have looked over the incomparable mineral deposits or lain on the hillside, sloping to the west, and seen the reflection of old Soltudus in the mirror-like surface of the silver lake beneath you, you will say that not in all the world, not even in Switzerland, can such surpassing beauties be found.

Burton H. Allbee.

SOLDIERS' MONUMENTS AT THE WORLD'S FAIR.

THE progress of the work by the general managers connected with the exhibit of the state of New York at the world's fair, and that of the judicial district commissioners, has developed and emphasized the fact that in regard to interesting and important matters directly connected with the state, bearing on its credit and the gratitude and public spirit of its citizens, and in which the public has a deep interest, to accomplish which, state aid in many cases has been invoked either by appropriations or legislation, statistics in regard to the work accomplished are entirely wanting; and yet, as illustrative of the development of the state, its progress and liberality, it is necessary to refer to them. Throughout the state, in cities, villages, hamlets, cemeteries, public squares and parks, monuments have been erected to the memory of the noble dead of this state, those who occupied prominent official positions, were benefactors or philanthropists, soldiers of the Revolution, the war of 1812 or that of '61, and yet no record of the same, or of the cost, or money expended therefor, is accessible.

In connection with the intended state exhibit, which will comprise statistics in regard to interesting subjects pertaining to the state and localities herein, a circular, a copy of which is published herewith, has been issued to the several judicial district commissioners, and responses thereto are now being received. When completed it will make a most interesting and instructive record, and supply an important chapter in the general history of our state. The photographs of the various monuments bound, will make a unique and interesting volume. It is hoped that citizens generally will aid the commissioners of the several judicial districts in securing full and accurate information in regard to the matter referred to in the circular.

My Dear Sir: I will be greatly obliged if, at the earliest date possible, you will furnish me the following:

First. How many soldiers' monuments are there in the ——— district, including monuments and memorial arches erected in memory of soldiers of the Revolution, the war of 1812 and the war of 1861-5, including also monuments on battle fields, if any?

Second. Specify how the monuments and arches were erected, whether by special act of the legislature, under a general statute, or by state, city, town, by assessment or private subscription.

Third. Give the cost of each monument and memorial arch.

Fourth. State the cost of placing the memorial in position.

Fifth. Give in full the inscription on each monument and arch, including the names.

Sixth. At what point and when erected, and by whom designed.

I appreciate the fact that to obtain this information will require time and considerable

correspondence, but I desire the information asked for shall be full, complete and accurate. I wish, also, to secure information in regard to any monument in your district erected by the public in memory of any distinguished citizen of the state, giving full particulars as to the cost, by whom erected, etc. If practicable, please procure photographs of the several monuments and arches. The expense you are subjected to necessarily, in procuring photographs, I will remit to you on being advised of the sum expended. Very truly yours, DONALD MCNAUGHTON,
Chief Executive Officer.

The publication of the list of soldiers' monuments in this state will stimulate localities which have been remiss in honoring their soldier dead, to activity in getting in line with localities which already have done themselves credit by honoring the brave dead.

IMITATION GEMS.

A DISCOVERY which promises to be of the most importance has been made by one of our Glasgow scientists, says the Glasgow *Herald* (Scotland.) Although imitation gems are obtainable in any required quantity, the production of crystals having the hardness, durability, and other qualities, both physical and chemical, of natural stones has been one of the unsolved problems of applied chemistry. The most advanced efforts up till now have been made in Paris, and the French specialists have at least proved the possibility of producing sapphires, rubies and other stones by artificial means, their products being real gems, and not glasses. It is doubtful, however, if the originators of the French methods themselves claim that theirs are the methods of nature, and it is reasonable to suppose that the most natural method will be the most practically successful one. Although no geologist or chemist can declare the new process to be the process of nature, yet many analogies point that way. Experimenters in this field may have been partly discouraged by the thought that the gems of nature were produced under conditions of enormous pressure, to which might have been added very high temperatures, and that they were in some cases the products of long periods of time. It is possible, however, that too much weight has been given to this point. In the process now under notice no such discouraging conditions are present, and the method is wonderfully simple. Even working on the laboratory scale, using small vessels, stones have been obtained over one-sixteenth of an inch in diameter, and very large numbers have been formed approaching that size. There is no reason to doubt that working on a larger scale will yield stones of any size likely to be required. The noble naturre of the products is beyond doubt, as they are very hard, infusible at all ordinarily attainable temperatures, and insoluble in any acid. The

bulk of the gems are white, or rather colorless, sapphires. They are compact and transparent crystals, and many specimens have a splendid luster. By subsequent treatment some of them have taken on the sapphire blue. Some of the specimens seem to obtain a small amount of carbon. This element is sometimes present in small quantity in natural emeralds, a fact not generally stated in books on the subject. In a few specimens the proportion of carbon seems to be considerable, and there are present individual crystals having physical properties more nearly allied to the diamond than to the sapphire. In nature diamonds are often found associated with other gems. In any case the products contain little or no silica, this compound being the characteristic ingredient in all kinds of glass. Apart from the possibilities of the process in the direction of producing the diamond, the chief point already established is that of having found an easy method of crystallizing alumnia. The oriental ruby, oriental amethyst, and other gems coming under the heading "oriental," are all of them only variously-colored sapphires, and alumina forms the chief constituent of the series. There is little doubt that the process will yield the ruby and other varieties. Apart from ornamentation, their hardness will fit them for mechanical purposes, and their cutting power is remarkable, perhaps due to the small amount of carbon already spoken of. The author of the process has sought the opinion of several of the foremost men of science, and their general verdict has been very favorable. The discovery may prove to be one of the most important yet made in mineralogical chemistry, and the future developments both commercially and scientifically difficult to estimate. The originator of the process is James Morris.

THE BEST ROAD STONE.

COMPARATIVE experiments, made with a view to ascertain the kind of stone best adapted for roads, show the specific gravity of a rock is really no indication whatever of its fitness for such a purpose, slate, for example, weighing 175 pounds per cubic foot, and pure mica, weighing about 183 pounds, being entirely unserviceable. It is thought by some that trap rock has no superior for this use, after this coming felcite, and next in order is granite, though in regard to the latter there is to be considered the difference in quality that exists, the kind containing hornblende being preferable to that with mica; the latter sort is soft, rendering it much inferior to the former.—*Poughkeepsie News-Press.*

ARCHITECTURAL MODELS.

WHEN a building of great magnitude is to be erected, the cost of a model, although it may be considerable in itself, becomes a mere trifle in the sum-total. Where merely the facade of a building will be exposed to view, a model may be dispensed with, as a sample elevation will answer the purpose perhaps quite as well. But for one that is insulated, or is at all complex, a model becomes desirable. The same again if a facade is composed of many parts or surfaces, some projecting, others retiring, the effect of which cannot else always be so distinctly foreseen as it ought to be, at least not except perspective drawings be made of it from several different distances and points of view, and if there be many of these, they will be hardly less expensive than a model itself. Besides, even when an architect has thoroughly considered all his preparatory drawings, he may still find out something that, if not absolutely faulty, may be considerably improved —something that he had thought would have had a different effect, and which therefore, if detected in the model, can still be remedied. For showing the internal parts of a building models are of comparatively little use, since they may be far more distinctly understood by means of plans of the different floors and sections. Indeed, unless a model be made to open or be so constructed that either one or more of its sides may be removed at pleasure, so as to lay open the interior, the inside of a building can hardly be shown at all in a model. Hence models are very seldom indeed resorted to for such purpose, and then only to show a single large apartment, such as the interior of a church, or something of that sort, whose construction requires to be so explained, for it is hardly necessary to observe that the most accurate and best-executed model cannot in such cases give the effect of the building itself as viewed when we stand within it. After all, useful and unsatisfactory as models are, they are apt in some degree to mislead unless due precaution be taken to guard against misconceptions. As a miniature representation of a building, more especially if it be beautifully finished up, a model possesses a certain prettiness of its own which captivates the eye, and is likely to cause it to overlook the commonplace or trivial character perhaps of the design so shown. Another imperfection attending a model is that it conveys no idea of the situation, but merely shows the building itself, apart from all its accessories, probably its disadvantages of locality. A model of St. Paul's, for instance, may be viewed in any direction and from

any distance, whereas the building itself can be seen only by looking directly up at it, except from one or two points. It is necessary, therefore, that any delusion of this kind may be carefully guarded against, at least in an edifice of importance, by an exact plan of the situation, and one or more views, as may be, showing it as it will actually appear when erected. On the other hand, it is one circumstance greatly in favor of models, that after they have served their first purpose they have their value as ornamental works of art.—*The Architect, London.*

A NOVEL BUILDING PROJECT.

L. De SMIDT is a Belgian who proposes a project to the chamber of commerce that knocks out anything yet suggested. It is a structure compared to which the colossus of Rhodes and the Eiffel tower would seem small affairs. The cost would be about $2,000,000 or thereabouts, a sum which he is confident Denver could raise in a week, if the public once grasped an idea of the value of the structure as a mere adventure.

The drawing he submits says the Denver, (Col.,) *News*, shows a building constructed as an arch over a street, and he suggests that a suitable site be at the Union depot, where it could be styled "the Gateway to the Great West," or bear some other appropriate symbolical designation.

Each of the legs of this giant arch is a massive business block sixteen stories high and surmounted with a tower rising 400 feet, representing the number of years since the discovery of America. One tower is crowned by an observatory and the other by a huge geographical globe. Numerous elevators are designed to separately serve the towers and the business portion of the block. Each of the legs is ninety feet square, the depth of the arch along the street thus being ninety feet, the same as its width. About half a block on each side would be necessary for beautifully laid out grounds which would permit the symmetrical proportions of the building to appear in all their majesty. Provision is made for ample lighting facilities within and without the arch by day, while at night clusters of powerful arc lights artistically arranged would illumine the surroundings.

Niches are provided for statues of the signers of the Declaration of Independence, the presidents of the United States and other great men. Allegorical groups of varied character add beauty to the ensemble. Within, besides the hundreds of offices which are to make the enterprise remunerative are auditoriums suitable for large gatherings. Above the richly sculptured facade of the great arch facing the depot are constellations of revolving lights representing the original thirteen and the present forty-four states and other national and historical subjects. Above these, surmounting the

arch and midway between towers at a height of 285 feet is a musical balcony in the form of a mammoth shell.

Here could be placed an orchestra with every variety of instruments and by an ingenious arrangement, like to the ancient ear of Dionysius, the music could be heard, not only all over the city, but the occupants of each room could enjoy its strains while resting at ease in the privacy of their chambers.

There are many other striking features included in the plan and the entire construction would, of course, be of the most enduring and finished character.

CARE OF TOOLS.

ONE of the duties of the smith, as it is the duty of workmen in every department, is to keep his tools in order. The great trouble in the smith-shop is the battering of the heads of tools, and faces of hammers.

This battering is due to impact, which is a change of the molecules induced by heat generated by motion. The constant blows set the molecules in motion and cause crystallization, which is simply the forming of the molecules into crystals, which are the natural form of solids as the spherical is of liquids, and by this reformation of the molecules, their cohesive powers are weakened and the strength and resistance of the tool lessened. Steel hammers and sledges become crystallized in less than a year, from constant use, and chip off at the outer edges and sometimes inflict painful wounds. More than one such case has been recorded where chips from hammers have caused the loss of an eye, and where serious wounds have been the result of a careless failure to keep the hammers dressed up.

Hammers and sledges also become hollow on the face, from constant use and neglect, which not only unfits them for use, but makes them liable to split. They frequently split at the eye, which is caused by crystallization, and those which are fullered at each side of the eye frequently break at the fullered portion, causing more or less damage and injury.

Aside from the danger of this neglect, the quality of the work is lowered. Imperfect tools cause the twist in the iron when swaged and the unevenness of the fullering, and that in smoothing off a flat piece of iron, one side becomes thinner than the other, and so on to the end of the chapter, so that, beside being a safer way, it is a more economical way to have the tools kept in proper order. If there is anything that looks shiftless, it is a tool bench with tools all battered up. While it is, of course, utterly impossible to have the heads in the best condition when the tools are in constant use, there is

no necessity for leaving them till they are battered way down to the eye and beyond all usefulness and hope of repair, when an occasional dressing and repairing would make them safer and more useful, and at the same time increase their durability. The thrifty workman will not allow this state of affairs to remain, and will find time to keep his tools in good order, however busy he may be; as he realizes that it pays to do it, and in reality saves time in the work. A workman who understands his tools and how they are made will understand how to do this, and needs no advice; but to the apprentice, any suggestions in every line that pertains to his labor are welcome, and in the future we hope to have something more to say on this subject.—*Amesbury Vehicle.*

CEMENT CONCRETE TESTS.

A LARGE number of experiments have been made by the engineers of the Melbourne Metropolitan Board of Works as to the desirability of bluestone toppings and screenings being substituted for sand for making Portland cement, concrete, or mortar for the main outfall sewer. The results show that the substitution is advantageous; that samples or briquettes made with Beaconsfield sand and cement, and bluestone toppings and cement, in the same proportion—viz., 2 to 1 of cement—show the strain required to break the briquettes was much greater with the latter material than with sand. As to the crushing strength of the concrete, this being the chief requirement for sewers, the experiments made showed conclusively that from ratios of 1 to 8 to 1 to 15 the mortar made with bluestone toppings was much stronger than that made with sand. Other series of tests prove the same superiority of bluestone toppings in every case, and the authorities have decided to allow either bluestone toppings or sand to be used for the outfall sewer, whichever is the cheaper. Comparing the strength and cheapness of the various concretes, the following give very good results: 1 of cement, 4 of bluestone toppings, 1 of bluestone screenings, and 1 of bluestone; also 1 of cement, 3 of bluestone toppings, 2 of screenings, and 2 of bluestone; also 1 of cement, 2 of bluestone toppings, 2 of screenings, and 3 of bluestone. Of these the latter is recommended for the sewers. The general results are thus summarized: "(1) Neat Portland cement is stronger both in tensile and crushing strength than any mixture; (2) that Portland cement mixed with bluestone toppings to form a mortar is always stronger if sand be substituted for toppings; (3) that mortar composed of 1 of Portland cement and 1 of bluestone toppings is reduced in strength by the addition of screenings; that the addition of two parts of screenings increases the strength of the poorer mortars, and that the maximum strength

is obtained by the addition of one part of screenings to mortars of ratios 1 to 2 to 1 to 5; (4) that in Portland cement concretes the best result with any mortar is given when combined with one part of screenings and 1 part of stone; that the increase of screenings has a tendency to weaken the concrete if more than 1 or 2 parts be used; that with mortars poorer than 1 to 2, 2 or 3 parts can be added without materially reducing the strength."

ORDER OR ANARCHY?

WE are confronted at this moment by masses of discontented men, who, in the endeavor to attain their own ends, do not hesitate to strike ruthlessly at the common safeguards of the American Commonwealth —which are a respect for the rights of others and a conscientious regard for the duties of citizenship. These men have identified the right of protest with the savage instinct to destroy. They are making war not against capital but against labor. They shout freedom, but they act the most intolerable tyranny.

If the ignorance and fatuity which mark this desperation of class interest have taken root broadly in the American people we may well despair of Democracy. If that tolerance and respect for law which have built up our solidarity of practice have given out we are indeed upon the eve of a sickening revolution that will make the patriot and the humanitarian lose faith in the race.

There are not wanting surface indications of such a crisis. When the agents of great public interests have to appeal continuously to the military to protect those interests from the mob, when travel and manufacture have to look to the strong arm of the State to carry on their necessary functions, we may well believe that there is something wrong or at least something lacking in the people themselves.

That this is only a surface indication and does not warrant pessimistic conclusions, it is one of the privilages of the hour for the sagacious American who believes in his country to see.

Under and behind all the disturbances of these currents still flows the great silent tide of popular obedience and American intelligence.

In some irresistible way the consensus of opinion and of will must make itself felt and known.

The wisdom of prudence is in letting well enough alone when it has the warrant of a third of a century of progress and patriotism, and above all else the people, we confidently believe, will desire to express their condemnation of un-American methods, their intolerance of imported brutality and class hatred, and their close adhesion to law and order by avoiding a

revolution in sentiment as firmly as they have just put down a revolution in arms. Aside from all other minor issues involved in election the great duty of American people is to make their choice an overwhelming decision in favor of conservatism and an unanswerable rebuke to the proletarian demagogy which is responsible for so much of the present un-American outbreak.—*New York Evening World.*

WIDE VARIATION IN BIDS.

WE present, simply as an example of the different methods of figuring on results, the following bids for the interior marble work on the Massachusetts state-house extension. They were as follows:

Norcross Bros, for Italian marble, $188,000; if fossilized Echaillon is required, $21,000 added; for Sienna marble columns, $3,600 added.

Charles E. Hall & Co., for Italian marble, $242,150; for fossilized Echaillon marble, $5,700 added; for Sienna marble columns, $5,500 added.

Davidson Bros, for Italian marble, $235,589; for fossilized Echaillon, $22,000 added; for Sienna marble columns; $9,640 added.

Bowker, Torrey & Co., for Italian marble, $265,263; for fossilized Echaillon, $54,833; for Sienna marble columns, $9,388; for polished granite shafts, $1,460 added.

Batterson, See & Eisele, for Italian marble, $396,000; for fossilized Echaillon, $15,300, for Sienna marble columns, $8,000 added; if polished granite shafts, deduct $4,000.

Some of our readers may wonder why there should be such a difference among the bidders, as for instance, on Italian marble, or Echaillon, or Sienna —in the general average—the presumption being that the specifications called for one class of each material. The common average for Italian would be, as illustrated inthese bids, $265,520, and yet there is a difference between the highest and lowest bidders on this item of $205,400.

On Echaillon the difference is even more remarkable. The common average on this stock is a bid of $23,766, and yet there is a difference between the highest and lowest bidder on this item of $49,133.

There may be some errors in the presentation of these figures, which are taken from the Boston *Herald's* report, but, except for the extraordinary differential here illustrated, the bids afford a graphic example of the remarkable figuring often indulged in by bidders for large work.

"Copy of STONE is at hand. It is an excellent work and an honor to the stone business. We will be pleased to receive it regularly."—*Southern Stone and Monumental Co, Chattanooga, Tenn.*

GRANITE IN NORTHAMPTON COUNTY, PA.

THE Bethlehem (Pa.) *Times* says an almost inexhaustible deposit of first-class granite, discovered two months ago by George R. Herstine, of South Bethlehem, will soon be quarried by a company from that city. Two months ago he found out that granite existed at Rocktown, in Williams township. It is situated a mile west of Raubsville, on the Delaware, and four miles from Easton. The land is owned by Samuel Raub and was formerly the famous Dr. Wilhelm's farm. Mr. Herstine kept the matter quiet and ascertained the worth of the granite. Experts found it susceptible of a very high polish and invulnerable to all acids. It contains not a particle of iron, the principle which renders so many kinds of granite liable to rust. The granite makes the finest building stone and beautiful monuments and will be very servicable for curbing and posts for cemetery lot fences. All the stone-cutters in this vicinity are enthusiastic over the new granite. Samples were submitted to them and all have given orders for a trial lot. The granite covers thirty-five acres and is the only ledge of granite of any account in Northampton county. It is said no other farms in the neighborhood contain any of this valuable stone.

The deposit, which is syenite granite of a grayish blue color when polished, is bounded on all sides by an exceedingly good grade of limestone. An upheaval ages ago left the granite ledge there. Large quantities extend above the surface. Huge blocks sixteen feet high and forty-five feet long only await being broken up and carted away. The depth of the deposit is unknown. Extensive machinery will be erected as early as possible. Either steam or electric drills will be used in quarrying the stone. An expert from Lehigh University has estimated that the deposit contains at least 2,000,000 tons of granite and it may be four or five times this amount. —*Wind Gap Dispatch.*

MEXICAN MARBLE.

THE marble of Galeana (Chihuahua) is comparable to that of Carrara; that of Tecali, which, although a marble, is known to every one in the United States under the name of Mexican onyx, is of admirable transparency and variety of color. The state of Nuevo Leon produces a great variety of colored and white marbles, and the same might be said of almost all the other states. The gray, black and other colored marbles, more or less beautiful, of Orizaba (Vera Cruza) constitute to-day one of the vastest and most important affairs in Mexico. The quarries are very numerous and their exploitation is developed day by day.

STONE PRODUCTION.*

THE present report on stone in the United States is intended particularly to show the distribution by counties of the different varieties in the various productive states and territories. With this purpose in view, each productive state and territory is treated of by itself. The statistical figures apply in the large majority of cases to the calendar year 1889, and they serve to show the relative magnitudes of the industries. In addition to the subject of distribution, other features of interest in regard to the properties, the chemical constitution and physical structure of the stone and the purposes to which it is applied are included in so far as the data at hand at this time will permit.

In 1889, there were produced in the United States limestone, granite, sandstone, marble, slate and bluestone, named in the order of their commercial importance.

The total value of this stone product, according to the results of the eleventh census, was $53,035,620, distributed as follows: Limestone, $19,095,179; granite, $14,464,095; sandstone, $10,816,057; marble, $3,488,170; slate, $3,482,513; and bluestone, $1,689,606. In 1890 no such detailed canvass of the United States was attempted as was executed in the previous year for the eleventh census. Building was more active in 1890 than in 1889, and the total shows fully the normal growth to a total value for stone of all kinds of $54,000,000.

GRANITE.

Production.—The value of the granite produced in the United States in 1889 was, as shown in the following statement, $14,464,095. This product was distributed among 28 states and territories, as follows:

PRODUCTION OF GRANITE IN THE UNITED STATES IN 1889, BY STATES AND TERRITORIES.

Rank.	*States.*	*Value of Output.*	*Rank.*	*States.*	*Value of Output.*
1	Massachusetts	$2,503,503	16	South Dakota	$304,673
2	Maine	2,225,839	17	Wisconsin	266,095
3	California	1,329,018	18	New York	222,773
4	Connecticut	1,061,202	19	Delaware	211,194
5	Rhode Island	931,216	20	North Carolina	146,627
6	Georgia	752,481	21	South Carolina	47,614
7	New Hampshire	727,531	22	Oregon	44,150
8	Pennsylvania	623,252	23	Texas	22,550
9	Vermont	581,870	24	Utah	8,700
10	Missouri	500,642	25	Montana	76,000
11	Maryland	447,489	26	Arkansas	
12	New Jersey	425,673	27	Washington	
13	Minnesota	356,782	28	Nevada	
14	Virginia	332,548			
15	Colorado	314,673		Total	$14,464,095

*Report of United States Geological Survey for 1889–90.

Uses.—The purposes to which the granite product was put were as follows: Building, $6,166,034; street work, $4,456,891, cemetery, monumental, and decorative purposes, $2,371,911; bridge, dam and railroad work, $1,238,401, and miscellaneous uses, including millstones, walls (fences), watering troughs, posts, engine and machine beds, yard stock, boundary stone, horse blocks, etc., $230,858.

MARBLE.

Production.—The value of the marble produced in the United States in 1889 was $3,488,170. This was the product of ten states, as follows:

PRODUCTION OF MARBLE IN THE UNITED STATES IN 1889, IN STATES.

Rank.	*States.*	*Value of Output.*	*Rank.*	*State.*	*Value of Output.*
1	Vermont	$2,169,560	7	Pennsylvania	$121,850
2	Tennessee	419,467	8	Massachusetts	
3	New York	354,197	9	Idaho	
4	Georgia	196,250	10	Virginia	
5	Maryland	139,816			
6	California	87,030		Total	$3,488,170

MARBLE IMPORTED AND ENTERED FOR CONSUMPTION IN THE UNITED STATES, 1867 TO 1883, INCLUSIVE.

Fiscal Years Ending June 30—	*Sawed, Dressed, etc., not over 2 inches in thickness.*	*Sawed, Dressed, etc., over 2 and not over 3 inches in thickness.*	*Sawed, Dressed, etc., over 3 and not over 4 inches in thickness.*	*Sawed, Dressed, etc., over 4 and not over 5 inches in thickness.*	*Sawed, Dressed, etc., over 5 and not over 6 inches in thickness.*	*Veined and all others in block, etc.*	*White, Statuary, Brocatella, etc.*	*Not otherwise specified.*	*Total.*
1867						$192,514	$2,540	$51,978	$247,032
1868						309,750	4,403	85,783	399,936
1869						359,881	3,898	101,309	465,088
1870						332,839	3,713	142,785	479,337
1871	$5,973	$168	$77	$44	$29	400,158	1,134	118,016	525,598
1872	3,499	1,081	452		318	475,718	4,017	54,539	539,624
1873	3,124	21				396,671	4,148	69,991	473,955
1874	1,837					474,680	2,863	51,699	531,079
1875	1,456	427	96			527,628	1,623	72,389	603,619
1876	595	126	203	87		529,126	1,151	60,596	591,884
1877	2,124					349,590	1,404	77,293	430,411
1878	198	11	8			276,836	592	43,915	421,660
1879	184					329,155	427	54,857	384,623
1880						531,908	7,239	62,715	601,862
1881	339					470,047	1,468	82,046	553,900
1882	655					486,331	3,582	84,577	575,145
1883	619					533,096	2,011	71,905	607,631

During the calendar years ending December 31, from 1886 to 1890, and fiscal years ending June 30, for 1884 and 1885, the classification has been as follows:

MARBLE IMPORTED AND ENTERED FOR CONSUMPTION IN THE UNITED STATES FROM 1884 TO 1890.

Classification.	1884.	1885.	1886.	1887.	1888.	1889.	1890.
In block, rough or squared, of all kinds...	$511,287	$429,186	$408,895	$355,648	$357,220	$498,275	$510,354
Veined marble, sawed, dressed, or otherwise, including marble slabs and marble paving tiles	12,941	43,923	96,625	142,405	107,957	115,909	142,653
All manufactures of, not specially enumerated..	67,829	54,772	44,053	31,880	69,086	61,231	132,376
Total	$592,057	$527,881	$549,573	$529,933	$534,263	$675,415	$785,383

SANDSTONE.

Production.—The total value of the sandstone produced in the United States in 1889 was $10,816,057. The states contributing to this total were, in the order of output, as follows:

PRODUCTION OF SANDSTONE IN THE UNITED STATES IN 1889, BY STATES AND TERRITORIES.

Rank.	States and Territories.	Value of Output.	Rank.	States and Territories.	Value of Output.
1	Ohio	$3,046,656	22	Alabama	$43,965
2	Pennsylvania	1,609,159	23	Montana	31,648
3	Colorado	1,224,098	24	Arkansas	25,074
4	Connecticut	920,061	25	Illinois............	17,896
5	New York...............	702,419	26	Wyoming............	16,760
6	Masshachusetts....	649,097	27	Texas	14,651
7	New Jersey.	597,309	28	North Carolina..........	12,000
8	Michigan................	246,570	29	Virginia................	11,500
9	New Mexico	186,804	30	Maryland............	10,605
10	Wisconsin...........	183,958	31	Arizona	9,146
11	California............	175,598	32	Oregon............	8,424
12	Missouri............	155,557	33	New Hampshire..........	3,750
13	Kansas............	149,289	34	Tennessee............	2,732
14	West Virginia........	140,687	35	Idaho............	2,490
15	Minnesota............	131,979	36	Rhode Island..........	26,199
16	Kentucky	117,940	37	Nevada	
17	South Dakota............	93,570	38	Vermont.	
18	Iowa	80,251	39	Florida............	
19	Washington	75,936	40	Georgia	
20	Utah	48,306			
21	Indiana	43,983		Total....	$10,816,057

Uses.—The principal use to which the sandstone product of 1889 was put was for building, $7,121,942 worth, or over 65 per cent. of the product being devoted to this purpose; for street work, a quantity valued at $1,832,822 was used, while bridge, dam, and railroad work consumed $1,021,920 worth of the product. For abrasive purposes $580,229 worth was used, and for miscellaneous uses, $259,144. The last classification includes the stone used for grout, hitching-posts, fence walls, sand for glass, sand for plaster and cement, furnace hearths, lining for blast furnaces, rolling-mill furnaces,

adamantine plaster, millstones, cemetery work, watering troughs, fluxing, ganister, firebrick, silica brick, lining for steel converters, glass furnaces, core sand for foundries, and random stock.

LIMESTONE.

Production.—The value of the limestone produced in the United States in 1889, as shown above, was $19,095,179. It was produced in 40 states and territories as follows:

PRODUCTION OF LIMESTONE IN THE UNITED STATES IN 1889, BY STATES AND TERRITORIES.

Rank.	States and Territories.	Value.	Rank.	States and Territories.	Value.
1	Pennsylvania	$2,655,477	22	Connecticut	$131,697
2	Illinois	2,190,607	23	New Jersey	129,662
3	Indiana	1,889,336	24	Massachusetts	119,978
4	Missouri	1,859,960	25	West Virginia	93,856
5	New York	1,708,830	26	Michigan	85,952
6	Maine	1,523,499	27	Tennessee	73,028
7	Ohio	1,514,934	28	Idaho	28,545
8	Wisconsin	813,963	29	Rhode Island	27,625
9	Minnesota	613,247	30	Utah	27,568
10	Iowa	530,863	31	Montana	24,964
11	California	516,780	32	Arkansas	18,360
12	Kansas	478,822	33	South Carolina	14,520
13	Alabama	324,814	34	New Mexico	3,862
14	Kentucky	303,314	35	Oregon	
15	Washington	231,287	36	Georgia	
16	Texas	217,835	37	Florida	77,935
17	Nebraska	207,019	38	Arizona	
18	Vermont	195,066	39	South Dakota	
19	Maryland	164,860	40	Wyoming	
20	Virginia	159,023			
21	Colorado	138,091		Total	$19,095,179

Uses.—The principal purpose for which the limestone was used was for the production of lime, the value of the lime produced being $8,217,015. For building purposes $5,405,671 worth was used; for street work, $2,383,456; for a flux in blast furnaces the limestone used was worth $1,569,312; for bridge, dam, and railroad work, $1,289,622, and for miscellaneous purposes $230,103 worth was used.

SLATE.

Production.—Slate valued at a total of $3,482,513 was produced in the United States during 1889. Twelve states contributed to this product as follows:

PRODUCTION OF SLATE IN THE UNITED STATES IN 1889, BY STATES.

Rank.	States.	Value of Output.	Rank.	States.	Value of Output.
1	Pennsylvania	$2,011,726	8	Georgia	$15,330
2	Vermont	842,013	9	New Jersey	10,925
3	Maine	219,500	10	Michigan	
4	New York	126,703	11	Arkansas	15,240
5	Virginia	113,079	12	Utah	
6	Maryland	110,008			
7	California	18,089		Total	$3,482,513

Uses.—By far the greater portion of the slate produced in this country is

used for roofing purposes, the value of the slate thus used in 1889 being $2,797,904, while that devoted to other purposes was valued at $684,609.

BLUESTONE.

Production.—This variety of sandstone was produced in only three states, the total value of the product being $1,689,606, divided as follows:

PRODUCTION OF BLUESTONE IN THE UNITED STATES IN 1889, BY STATES.

Rank.	*States.*	*Value of Output.*
1	New York	$1,303,321
2	Pennsylvania	377,735
3	New Jersey	8,550
	Total	$1,689,606

Uses.—Originally bluestone was used for flagging only, to which purpose the larger portion is still applied, but the use of it has extended to other purposes, such as rubble masonry, retaining walls and bridge stone, sidewalks, curbing, gutters, stepstones, flooring, vault covers, bases of tombstones, porch and hitching posts, and house trimmings.

William C. Day.

[TO BE CONTINUED.]

A UNIQUE MANTEL.

A WOMAN who is building a home on a bluff of the Mississippi river, will have the big chimney-piece in the hall constructed of stone from every state in the Union. Each has been contributed by a friend, and, as in asking, the size has been designated about that of a medium cobblestone, symmetry is preserved. She already has one from Alaska, and also several washed by the waters of the Gulf of Mexico. The house itself is built of stone, "but my cobblestone mantel," writes the woman, "will be the pride of the place."

"I have received a late issue of STONE, and find it even more attractive than usual, if such a thing is possible, as I have always found it exceedingly interesting and instructive."—*C. E. Fish, New Castle, N. B.*

"Have received two numbers of STONE in its new form and must compliment you on its thorough get up."—*Fred E. Yorke, Belvidere, N. J.*

HOME OF THE HORSE—HOW TO BUILD IT.

EVERY quarryman employs the horse in his business. The proper care of the noble animal should be one of the first duties of every owner. We append herewith a very sensible article from the *Sanitarian* relating to the construction of healthy and comfortable stables, which will prove of interest. It has particular reference to stables constructed in cities, but the advice is pertinent under all circumstances:

There is no need whatever that a stable should be a nuisance anywhere, and when it is so, the fault is, firstly, in the building and maintenance; secondly, and chiefly—to the public—the process of removing the manure previously stored in vaults or bins, or kept in heaps in the stable.

Plank floors to stables are a common nuisance to the neighborhood on account of the noise and stench—the wood absorbs the urine and other liquid filth and speedily becomes foul and stinking; the ground underneath becomes saturated with the leakage, and the putrefaction there set up and maintained evolves gases alike noisome and unhealthful to the horses and to all persons who breathe him.

Stables in basements—many with their ceilings on a level with and some below the street pavement—with areas for manure, insufficient light and impure air, protected by gratings, are inconsistent with public decency and healthful conditions to the people round about and to the horses kept within.

The horse is a noble, sensible and sensitive animal. He knows more and suffers more than most people think, and he should be treated with more tenderness and humanity, even independently of consideration for the health of the people. Commodiousness, cleanliness, and ventilation are primary conditions of stables for the health of horses and freedom from nuisance to persons living in the neighborhood of stables.

It has been ascertained with approximate accuracy by observation and experiment that a horse to be healthy requires eight thousand cubic feet of fresh air hourly, and that this amount cannot be supplied without dangerous draught in less than sixteen hundred cubic feet of space; and this estimate, it should be borne in mind, is based upon the spoiling of the air by respiration and cutaneous exhalation; it takes no account of uncleanly conditions, which, if present, add to the deterioration. It is generally conceded that, under ordinary circumstances, every adult man renders absolutely irrespirable five cubic feet of air hourly; and that to purify this amount and

maintain the highest degree of practical purity in his immediate surroundings, not less than three thousand cubic feet of fresh air per hour is required—six hundred times the amount spoiled by respiration. Compare this and man's breathing capacity with that of the horse, and the need of stable space for horses at once becomes apparent.

But horses are even more sensitive to some foul gases, if not indeed to all, than men. For instance, to sulphuretted hydrogen—that which is evolved from the bilge water of a filthy ship—a man will stand with comparative impunity, for a considerable length of time, an atmosphere containing one part of this gas in two hundred and fifty, while half as much will quickly sicken and, if long persistent, kill a horse.

The gases evolved by the putrefaction of the excreta of horses are poisonous, like the gases evolved from the putrefaction of any other animal matter. Yet there are some persons so foolish as to assert that the odor of a stable is healthful, just as there are some dunces who think that the smell of a sewer or privy vault is of no consequence.

The urine of horses contains about six times as much putrescible matter as the dung, and is therefore six times more dangerous, and the more because it soaks into the floors, if they are permeable, and into the ground beneath. Wells in the vicinity of such stables have frequently been found so impregnated with ammonia as to smell and taste of it. Clearly, therefore, no stable should be tolerated without an impervious floor.

Such a floor, comparatively noiseless, can be constructed of asphalt or cement at little if any more cost than of wood. All stables should be carefully drained, and all liquids from them should be discharged into the sewer with as much care as the sewage from any house for human habitation. Tight vaults and bins for manure storage and long-retained heaps of manure in stables, promotive of its putrefaction, should be rigidly prohibited. Bins, if allowed at all—better that they should not be, only under restricted conditions—constructed of iron bars, as cages, so as to admit of the free exposure of the contents to the air, situated in the coldest available place, and emptied sufficiently often to anticipate putrefaction. Even heaps of manure, if allowed to lie long, are liable to ferment, and then when disturbed to give off strong ammoniacal vapors. This result of ammoniacal emanations and consequent loss of the most valuable fertilizing property of stable manure may be almost wholly averted by frequently wetting the manure with a solution of copperas or dilute sulphuric acid, with the additional advantage of increasing its commercial value. Finally, the process of handling the manure with a view to its removal should be wholly done in the stable.

Why stables should have ever been permitted to deliver manure over the pavement to wagons in the streets was probably due, in the first place, to the tolerance of basement stables, with areas outside for manure storage, at a

period before there was any health organization in the city, and when the number of dunces who believed in the wholesomeness of manural emanations was greater than that of intelligent and decent people; but that such stables and such practices should be tolerated now is alike disgraceful to the health authorities and the community.

OUR CURRENCY.

THERE are in the United States so many kinds of currency that it is not strange that misapprehensions and a confusion of ideas should exist on the subject at home as well as abroad. First in order is the gold coinage, the basis upon which the whole circulation of the country rests. Should this become weakened the entire system would be likely to fall into confusion. The gold dollar is the only recognized legal "unit of value." By it only is measured the value of all foreign coins and bullion, whether of silver or gold. That the gold dollar rests on its own basis independently of government fiat, is seen by the fact that gold bullion is of the same value and performs the same function as the gold coinage in monetary transactions. The case is very different with the silver dollar and silver bullion. According to the latest estimate of the director of the mint, the stock of gold coin and bullion in the United States, including the coin in the treasury vaults, in the banks and in circulation, amounts to $687,000,000. As nobody can tell how much gold may be stowed away in stockings and other hiding places, this estimate is largely based upon conjecture so far as the gold in private hands is concerned.

Next come the standard silver dollars, of which a little more than $57,000,000 is in circulation, and about $357,000,000 is piled up in the vaults of the treasury. Upon this coinage, authorized by the act of 1878, about $327,000,000 in silver certificates are in circulation. The small remainder of silver certificates is in the treasury, to the amount of about $4,000,000. These certificates are legal tender for taxes, custom-house duties and other demands of the government. Under the act of July 14, 1890, no more of this class of silver certificates can be issued.

The greenbacks, the remainder of the legal tenders issued during the war, amount to $346,681,016, of which about $100,000,000 constitutes a portion of the reserve of the national banks. These greenbacks are a floating debt of the government, and while their amount cannot be increased, they may be issued and reissued as fast as returned to the treasury. For their redemption $100,000,000 in gold is held as a treasury reserve.

The national bank notes amount to $172,476,575, of which $168,067,089

is in circulation. The rest is "cash" in the treasury. While the national bank notes are not a legal tender in general, the national banks must accept them at par for all demands. This makes them legal tenders for all practical purposes.

Under the act of July, 1890, new silver certificates to the amount of $105,-000,000 have already been issued for the purchase of silver bullion, of which upward of $100,000,000 is in circulation. They are legal tender for all debts, public and private.

Of the gold certificates, of which $175,644,879 has been issued, $153,000,000 or thereabouts is in circulation; but most of this issue serves as a convenient reserve for the banks.

The subsidiary silver coinage amounts to $77,433,950, about $63,000,000 of which is in general circulation, and the rest is stored in the treasury vaults. This coinage is legal tender for no greater sum then five dollars.

Lastly, there are the current certificates, under the act of 1872, amounting to $30,550,000, nearly all of which are in general circulation.

This makes nine different kinds of currency, the total sum of which on the 1st of July, 1892, amounted to $2,241,096,694. Of this amount $1,529,-316,833 was in circulation on that date, and $627,524,450 was in the treasury. This whole fabric of currency rests upon gold as its base—in theory, at least, if not in fact. Whether the enormous volume of silver and of paper certificates upon this silver can be kept at par with gold will depend on the future policy of the government. If unrepealed, the bullion act of 1890 will sooner or later bring the currency to a silver basis.

ANCHORS.

IN the manufacture of its own chains and anchors, the United States claims to secure results otherwise unattainable on the score of strength and durability, even making its own iron, using nothing but the finest of malleable scraps, and the process is unique. The metal, says the New York *Sun*, as withdrawn from the furnace a glowing white mass, is rolled into long flat slabs of about one inch in thickness, which are cut up into short lengths, to be again subject to intense heat; these, being withdrawn, are rolled into billets of a few inches square at the ends and about two feet long, which are now for a third time thrust into the furnace, and at a white heat are taken out by means of large tongs suspended by a chain from an overhead trolley wheel, then rolled quickly into rods of various sizes and a number of feet long, being allowed to cool gradually in the air. The rods are now cut cold into short lengths for the links, which are formed by again heating and plac-

ing upon a special contrivance and turned into a staple shape, the staples being then linked together, completing the chain; the ends welded together by hand, the joining piece then put on—the link being then complete, so far as workmanship is concerned. To test the work, a long ditch running on one side of the shop is provided at one end with secure fastenings and at the other by a hydraulic engine, by means of which the chain is drawn tight and subjected to so many tons pressure; if, under this, a link breaks or exhibits any flaw, it is rejected.

DANGERS OF BOATING.

Clara—"When George and I are married I'm to have my own way in everything."

Dora—"Guess you won't."

Clara—"Indeed I will. That's the bargain. Don't you remember I told you he proposed to me in a rowboat, and asked if I'd float through life with him just that way?"

"Yes."

"Well, he was rowing, but I was steering."—New York Weekly.

"Your very excellent and interesting publication at hand. You are to be congratulated on the attractive appearance of this publication, as well as its valuable and interesting contents."—*Chas. W. Price, Editor Electrical Review.*

"We congratulate you upon the attractive appearance of STONE as now presented. The quantity and quality of the matter you give attracts and keeps the attention it so well deserves."—*New York Granite Co.*

STONE IN EGYPT, GREECE AND ITALY.

EGYPT abounds with rocks of calcareous stone, sandstone and granite, and all these materials have been employed in the formation of the massive works which yet remain to attest the magnificence of the ancient people of that country. The walls of most of the temples were constructed of sandstone, which appears to have been chiefly obtained from the quarries stretching alone the banks of the Nile, in the mountain of Silsileh; but the obelisks and statues which adorned these temples are formed of syenite or Oriental granite, drawn from the quarries in the islands of Philæ and Elephantine, and particularly from those vast excavations in the mountain terraces about Syene. The stone which has served for the pyramid of Cheops is a carbonate of lime, of a light grey color, and the same kind of stone forms the interior mass of the pyramid of Mycerinus, but the latter is covered with red granite. The monolith at Sais, in the Delta, was formed of a single block of granite, which was floated down the Nile on a raft, from the quarry in Elephantine. The masterpieces of Grecian sculpture were executed in the rich white marbles of Attica and the islands of the Archipelago. The quarries of Mount Pentelicus, near Athens, supplied the materials for the Parthenon and the Temple of Theseus in that city and for the Temple of Ceres and Proserpine at Eleusis, and both in Greece and Asia Minor an abundance of stone of greenish white was dug from the earth for the ordinary purposes of architecture. The marble of Pentelicus, which lies on the surface of the Rocky Mountains, was obtained by cutting the side of the hill into vertical cliffs, and about the foot of the escarpment there still remain some of the blocks of marble partly cut in forms for the shafts of columus. The quarries at Ephesus are said to have constituted an immense labyrinth, and that in the hill Epipolæ, with the stone from which the edifices of Syracuse were constructed, appears to have been of vast extent, since it was capacious enough to contain the 7,000 Greek soldiers who had been taken prisoners when the army of Nicias retreated from that city.

The quarries of the Greeks and Romans were worked by slaves, and as the labor was of a severe kind, we find frequent allusions to the practice of sending unruly slaves to work in the quarries as a punishment. We learn from Vitruvius that the buildings of ancient Italy were constructed with stones of several different kinds. This writer states that the quarries of Alba and Fidenæ (Albano and Castle Jubileo) produced a red and soft stone which soon decayed, and that the stone obtained from those of Tibur (Tivoli), Amiternum (Nitorino) and Mount Soracte was moderately hard. The Tiburtine or Travertine stone is a calcareous rock, and it appears that it was employed in

constructing most of the buildings of ancient Rome. The quarries in Umbria and Picenum furnished a white stone which could be cut with a saw, and would stand well in situations where it was sheltered from the weather, but was liable to be destroyed by rain or frost. On the other hand the red stone obtained from the quarries about the Vulsinian Lake (Bolsena), on the other borders of Tarquinii, would stand both frost and fire, and would last for ages, on which account it was generally employed for sculptured works. After the destruction of Rome by fire, in the time of Nero, the houses are said to have been rebuilt of the Alban and Gabian stone, which has the property of resisting the action of that element.

THE MASON BUILDERS OF BOSTON.

THE relationship between the employing masons and the bricklayers and journeymen stone masons in Boston affords one of the best examples in existence of the value of arbitration as advocated by the National Association of Builders. Since the establishment of the joint committee the relation between the employers and workmen has been one of perfect harmony. Various questions upon which the two differed have arisen from time to time, and have at once been referred to the joint committee for settlement. The action of the committee has been attended by the utmost deference and courtesy on both sides, and its decisions have been accepted by both sides without question. The importance of joint action at a time when both sides are desirous of securing only justice, and before the two sides have become embittered by struggle, cannot be overestimated. Questions of difference can under such circumstances be considered dispassionately and without that feeling of animosity which is bound to exist where the difference is allowed to create a strike or lockout. The mason business in Boston has never been in such good condition as it is at present, so far as the relation of the employer to the workman is concerned, and each day demonstrates more fully the value of the existence of the joint committee, which is virtually a board of reference composed of equal numbers from each side, with full power to decide all points at issue without cessation of work from any cause. The principal reason why arbitration is not more often effectual in the settlement of difficulties between employers and workmen is because it is not proposed until after a long struggle, and then only as a means for ending the fight. At such a time the mental attitude of each side is one of strong antagonism to the other, and it is more than likely that the side which considers itself the strongest would refuse arbitration in the hope of winning unconditionally. Arbitration to be effective must be in-

stituted as a preventive instead of as the last resort for a settlement. The principle is the same under all conditions, but human nature is such that its use under one condition would be perfectly satisfactory and successful, and under the other it would be useless except for the most temporary purposes.—*William H. Sayward, in Carpentry and Building.*

RAILROAD STATISTICS.

AT different times reference has been made to the methods by which railroad statistics are collected, and the difficulty of obtaining general figures in relation to the roads of the country. The Interstate Commerce Commission has undertaken to remedy this in part, and the report of its statistician presents some valuable figures. The recent publication of *Poor's Manual* gives us, according to the usual custom of its publishers, an introduction containing figures for a year later than those given in the Interstate report. The statements given in the *Manual* cover very nearly all the railroads in the country; the year is not uniform, different companies closing their fiscal years at different periods, but the totals given must approximate very nearly to correctness.

According to the *Manual* there was, at the close of 1891, a total of 170,601 miles of railroad in the United States, being an increase of 3,898 miles during the year. The mileage of the roads reporting their earnings, etc., was 164,262 miles, and on these lines there were in use 34,002 locomotives; 24,497 passenger and 7,368 baggage, mail and express cars; and 1,110,304 freight cars.

This property was represented by $4,809,176,651 capital stock; $5,235,295,074 funded debt; and $345,362,503 other debt. The last item, perhaps, does not exactly represent the real debt, as a large part of it consists of balances of accounts and similar matters.

The result of the operations of these roads was:

	1891.	1890
Gross traffic earnings	$1,138,024,459	$1,097,847,428
Working expenses	781,814,579	750,926,110
Net traffic earnings	$ 356,209,880	$346,921,318
Interest paid	231,259,810	225,799,682
Dividends paid	90,719,757	85,075,705

The average interest paid, including all debt, was 4.10 per cent., and the average dividend on stock was 1.85 per cent.

The average mile of road earned last year $6,926 gross and $2,168 net. Of the total earnings passenger traffic contributed 25.84 per cent., freight 67

and other traffic 7.16 per cent. The average passenger train earned 90.7 cents and the average freight train 152.8 cents per train mile.

The total traffic reported for the year was:

Passenger train mileage	320,712,013
Freight train mileage	493,541,969
Mixed train mileage	16,948,394
Total revenue train mileage	831,202,376
Passengers carried	556,015,802
Passengers—mileage	13,316,925,239
Tons freight moved	704,398,609
Tons freight moved one mile	81,210,154,523

From this it would appear that the average passenger journey was 23.95 miles, and the average freight haul was 115.29 miles. For the first time in a number of years there was a slight increase in the average rates, which for years past have been:

	1891.	1890.	1889.
Rate per passenger-mile	2.184 cts.	2.174 cts.	2.169 cts.
Rate per ton-mile	0.929 "	0.927 "	0.970 "

The figures indicate that the year was, on the whole, a fairly prosperous one for the railroads.

THE GREAT DUTCH DAM.

WORK upon the great dam which is the first step in the process of the draining of the Zuyder Zee is proceeding very satisfactorily. A good, solid, broad foundation has already been laid, extending from the north point of North Holland across to the Island of Wieringen, and thence straight across the Zee to the nearest point of the opposite cost of Friesland —a distance of eighteen miles only. It has been found that as the work advances the area itself assists by depositing enormous quantities of sand and silt every tide on both the outside and inside of the dam which is being gradually raised along its whole length simultaneously. When the project of draining the Zee took shape forty years ago, the first idea was to join by dams the great islands of the Texel, Vlieland, Terschelling, and Ameland to each other and to the main land at each end. The total length of dams required for this would have been only the same as that from Wieringen to the Friesland coast, and it would have reclaimed from the sea about half as much again as the present plan; but the tide going in and out through these openings four times daily, with tremendous strength, and in enormous volume, could not be coped with. It had hollowed out deep channels between the islands, from which it was considered vain to attempt to dislodge

it. When the tides have been excluded altogether subsidiary dams will be built and the water pumped out into the sea. The amount of land which will be reclaimed finally will be about 1,000,000 acres, more than one-tenth of the present area of the kingdom. It is estimated that the value of the recovered land will be 40,000,000 or 50,000,000 sterling in excess of the cost of the work.—*Chicago Tribune.*

DECREASE IN THE EXPORTS OF GREAT BRITAIN.

THE contiued decrease in the export trade of Great Britain is causing great disquietude among the manufacturers of that country. According to the Board of Trade returns recently published, it appears that the exports of iron and steel for the first six months of the year were 1,277,-802 tons, valued at £10,743,329, as compared with 1,662,208 tons, valued at £14,954,277, during the first half of 1891. The decrease was, therefore, no less than 384,406 tons, or 23.13 per cent. in quantity, and £4,210,958, or 29 per cent. in value. Seeing that the exports of 1891 were much lower than those of the previous year, we may well ask, with the British manufacturers, Where is this going to end? The decreases during January-June, 1892, as compared with January-June, 1891, are as follows:

	Decrease.	
	Tons.	*Per cent.*
Rails, etc.	191.131	50
Tin plates	99,429	32.5
Pig iron	29,518	8.4
Bars, angles, etc.	20,045	18.4
Hoops, sheets, etc.	19,826	26
Cast and wrought manufactures	17,270	9
Wire	6,393	20
Old material	9,804	18
Manufactures of iron or steel	2,429	27
Galvanized sheets	2,404	3

The export of machinery, hardware, cutlery, implements and tool, showed a decrease of 1.87 per cent., 12.15 per cent. and 2.6 per cent. in value, respectively, and the export of coals declined by 10 per cent. in quantity and 15 per cent. in value.

THE MEXICAN ONYX QUARRIES.

MR. WILLIAM COOPER, who has charge of the great onyx quarries of the Mexican Onyx and Trading Company, an American corporation, has been in the City of Mexico for a few days, states that the properties which his company are working, are located on the Hacienda

del Carmen, near Esperanzal on the line of the Vera Cruz railroad. The quarries now opened and from which large shipments of onyx are being made weekly, are known as the Old Salinas, New Selinas, Reforma, Palma and Blanco. In these quarries are found red, green, yellow, brown, white and varigated translucent onyx. Heretofore only 500 feet were shipped monthly to New York, but now the output is 1,500 feet, and the demand is greater for the onyx than orders can be filled.

In opening the quarries Mr. Cooper said that he discovered old workings over which new onyx had formed two feet thick. Between the new formation and the old were found ashes, charred coals, and about a ton of limestone balls five feet in diameter. It is thought that these balls were used to roll the onyx blocks out of the quarries probably hundreds of years ago, by the Toltecs.

EVERYBODY PLEASED WITH IT.

"I am much pleased with the copy of STONE received to-day and anticipate both pleasure and profit from its regularly recurring visits."—*E. T. Dumble, State Geologist of Texas.*

"Your publication comes first on the list of necessities in our business. Cannot say too much in its favor. Wishing you unlimited success."—*W. R. Smith & Sons, Otway, O.*

"Your magazine is just what we stone contractors want. Our firm is well pleased with it. Wishing you success."—*W. H. Fish, Secretary the Fish Stone Co., Columbus, O.*

"Your publication is a work of great merit and should receive a most liberal patronage."—*H. L. Wadsworth, Pub. Mining and Scientific Review.*

"We are more pleased than ever with STONE and greet its arrival with pleasure."—*The Beaver Dam Marble Co., Baltimore, Md.*

"The June number of STONE surprised and pleased me. You may send it regularly."—*P. F. Coleman, Louisville, Ky.*

EDITORIAL COMMENT.

IT has been estimated that the granite-cutters of New England, who have been on a prolonged strike—still on in some sections—had up to the middle of August lost in wages and in tribute to the unions, the sum of three million dollars, and in concession have gained practically nothing. At places where the strike has ended it has been on a compromise basis. We have seen no estimate of what the manufacturers' loss has been, nor those of contractors who have failed to complete their contracts because of this strike. It may safely be said that in money alone this strike has entailed a loss far up in the millions, and what has been gained in a moral sense? The strike has demonstrated that organized labor pitted against organized capital, must be a drawn battle always—and hence should not be left to the factions directly interested, but to some authority from the state judicially empowered, to settle it. In a nation like this such a conflict should receive the attention of the people's representatives, for the people as a mass are as much interested in having the right prevail as either the capitalist or the laborer in having their own way about it. Why should a nation of free men tolerate the menace of organized factional power of any character? Why should it be permitted? It is not the spirit of republican government to permit any faction of its citizens to organize offensively against another faction. That is revolution. It attacks the perpetuity of our institutions and the integrity of the government. It approaches anarchy, under which every man acts as if he were a law unto himself. It should be a crime, and a law should be fitted to deal with it.

BUT when we talk about a law being established to settle labor disputes, we meet the humiliating fact that law for such purpose must first pass the domain of politics, and party spirit is so debased, and parties so corrupt, that it seems hopeless to expect any legislation that might have a tendency to stampede the vote. Witness the spectacle of the congressional investigating committee at Homestead! Was it in the hearts of those politicians to seek the truth as to the cause of that disastrous affair, that proper legislation might be enacted, as much as it was to make capital for their respective political parties?

TURN from this to the example of the governor of New York, at Buffalo. The public interests were imperiled and crime was committed. The executive power of the state was invoked and the strike and destruction ended quickly. What the governor of New York did at Buffalo the governor of Pennsylvania should have done at Homestead, and there would

have been no marshaling of the Pinkertons, and no dead and wounded men as the consequence of dilly-dallying and scheming for partisan prestige.

SOME day these difficulties between employer and employé will be settled by means both just and effective. We do not undertake to outline the form which such adjudication will take, but the sober sense of the American people may be relied on to find the proper method at the proper time.

STONE has, through the stupidity of the secretary of the Concord, N. H., Granite Manufacturers' Association, become mixed up in a controversy between that association and W. H. Perry of Concord, who resigned his membership in the association while the strike was on. It seems that H. A. Rockwood, Perry's Western manager, wrote a letter to the *Monumental News* in which he deliberately stated that "the backbone of the strike was broken," assumably because Perry had withdrawn from the association. The *News*, which has a turtle's avidity for bait that looks fresh, snapped at the original offering, and the secretary of the association had his attention called to the publication. He reads STONE regularly and its freshness and originality is impressed upon him as it is upon everybody, and he indited a rejoinder to Rockwood in which bad blood was streaked throughout, and sent it to us for publication. It didn't appear. But he has given it out to other publications with the allusion that "Rockwood's letter in STONE" required answer, therefore his epistle. It is this reference that we rebel against. The *News* ought to have known that Rockwood, in Indiana, was not vested with knowledge or power, to declare the backbone of the strike in New England broken, simply because the firm he represented considered it good business policy to secede from the association. In publishing such an article at such a time the *News* justly incurred the censure of every member of the Granite Manufacturers' Association of New England. At the same time the secretary should at once, when apprised of his error, corrected the reference to STONE. His neglect to do so has placed STONE in a wrong light before the granite manufacturers of New England, a great many of whom are its subscribers and friends.

WE invite special consideration for our department of Legal News and Notes. The law is an expensive article that every business man must in his time buy more or less of. In preparing for this department we have employed the very best of legal talent to give opinion on law points that come close to the business of the people we represent. We invite inquiries on intricate questions of law from our subscribers. Put them in concise form and we will answer briefly in these pages. We cannot undertake to give exhaustive opinions, but the eminent attorney who edits the department will—for pay.

THE currency question involved in the steady depreciation of silver is now exerting great force in the world's commercial exchanges. The export of gold continues heavy, in spite of the volume of our exports, which for the fiscal year ended June 30, were $203,000,000 in excess of imports, and $163,000,000 more than in the preceding year. This gold export is due to the return of large blocks of our securities, and which, by the way, we seem to be absorbing without noticeable strain upon our financial resources. Whether this desire to realize upon the part of European investors be due to a

strain for ready money there, or due to a fear that our steady purchases of silver, with a potential possibility that we may adopt a free coinage system, inviting a considerable depreciation of currency, is not quite evident upon the face of things, but it is likely that both conditions are operating. The short crops of last year in Europe, while they compelled heavy buying, drew heavily upon the cash reserves, and could not but compel considerable liquidation of securities. The industrial relation of Great Britain, Belgium, the North of France, and Germany are suffering from great prostration, which many seem to ascribe to the operation of the McKinley bill; but such views do not seem reasonable under the fact of the very heavy imports into this country since the McKinley bill was legalized, that have surpassed any two years previously. The haste to anticipate the effects of the new tariff, that led to enormous imports before the date of its operation, would naturally create an undue activity in production, to be followed by an equal depression while the goods were in process of absorption. But perhaps the real cause is that of over-production and the rapid widening of areas of competition. Our own competition grows more and more serious as we increase in population and wealth, in which we are more or less rapidly imitated by Canada, India, Australia and the rapidly awakening energies of the Black Sea districts. The price of iron, that a thousand miles from seaboard only brings $13 per ton, and cotton that brings little over six cents per pound, with wheat and flour greatly depressed, and textiles and staple iron and steel goods following their natural products; we have the same stagnation here, but tempered in its degree and effect by a wider range of opportunity.

At any rate if the export of gold should continue as it has for the past two years, gold will be at a premium in less than three years, and we will be obliged to abandon the gold basis. Possibly the same necessity for gold will compel Europe to abandon its hostility to the double standard. It was evident during the Baring crisis that the store of currency in Western Europe was not equal to the necessities of trade, and since then there is noticeable a revulsion of sentiment there favorable to the resumption of silver as a money metal. There is no doubt that the extremely low price of silver has a far-reaching influence in the trade depression, and the result shows the destructive influence of maxims that an undeterminate political economy have upon existing facts. Both our cotton and our wheat are indirectly affected by the decline of silver, that enables Britain to pay for wheat and cotton in India in silver worth but 66 cents to the dollar in gold. The effect of this has been to involve India in a serious crisis, that forces exports at any price. But it has so reduced the purchasing power of the people of India that the reaction is profoundly felt by the Lancashire cotton mills, that in turn delimits the purchases of raw cotton. Great pressure is being put on the English government for a reversal of its single standard policy, while at the same time an effort is being made to demonetize silver in India. Which of the two forces will predominate in the near future is entirely problematical, but the habit of legislation tinkering with time-honored customs and the conditions that affect the lives of 90 per cent. of the world's inhabitants is resulting in a profound confusion that is growing more threatening each year in its social aspects. The policy may continue until gold will demonetize itself, through its inability to

act as the sole factor of currency basis, and the more other money is absolved from the money function, the more the demand will increase for gold, and it may follow that gold might go to a premium the world over, and disappear as money.

THERE is no doubt that the consuming nations—England and France—find it to their interest to increase the value of their bonds and by the same act depreciate the value of the raw materials they do not produce, and until the masses of those countries exert larger political influence and overpower the money-owning class that has absorbed all the lines of national prosperity, at least to the extent that their interests as producers should not be ruined while the interests of American and Indian producers are being ruined, these governments are not likely to permit any material change in their policy. But recent expressions from the British mercantile and producing classes show some indications that the government will be compelled to abandon a policy that is proving self-destructive. Our own Alliance, fiatists and political Utopians, and other exponents of maxims, have some cause for their discontent, but they do not see that a policy is dependent upon powerful factors far beyond the reach even of national legislation. So long as America is dependent upon Europe for the absorption of her raw materials, so long will she be obliged to conform to the conditions always imposed upon sellers, when the buyer has the choice of other and cheaper markets.

THE air is full of issues and isms, more or less forceful, but one of them, the labor question, is predominating all others. It is a question what this issue really is, or rather, what it is not, for it is a tissue of intangibilities, wanting in a specific purpose or plan, but covering all the theories for the regeneration of mankind. One is inclined to ask, when one reads the details of the switchmen's strike at Buffalo, where a complete paralysis of several important transportation systems was threatened that would materially injure a vast population more or less dependent upon it, why should a couple of hundred switchmen attempt to inflict so much damage, for such *puerile* results as they alleged in their complaint? The condition shows not only a lack of common business prudence, but also proclaims a selfishness so complete that it throws the oft-paraded selfishness and greed of capital into the shadows. Sagacity would indicate a policy of adopting means to ends, but the flagrant violation of the peace involved in the Buffalo incident shows a fanaticism that would undo not only the very bonds of society in general, but undo "organized labor," by withdrawing all sense of responsibility, discipline and respect for law and authority that must lie at the bottom of a successful trades union.

IF a trades union feels so sufficient unto itself that it prefers to set up a separate system of government of its own the members of it must at least obey their own laws. But it should be clear that so long as their own system represents but about 8 per cent. of the population that is not organized save under the common compact known as the law and constitutional government, that this 8 per cent. had better confine its efforts to the missionary labor of trying to convince the other 92 per cent. rather than by laboring to destroy the only organization that this much greater mass has of existing at all. It is wise to admit that there could be much improvement over

current conditions, laws and methods—that there are wheels within wheels, petty despotisms and despotic acts. But such do not invite the completer despotism of destruction of property, nor of the tying up of the energies of innocent people, especially as the effort is not accompanied by a specific plan for the general improvement.

But the Buffalo incident has resulted in a decline of the influence of the radical element of the labor cause. The refusal of the firemen or engineers to assist the switchmen out of mere sympathy has established a precedent that will add greatly to the moral strength of trades unions by its demonstration that principles of equity and respect for contracts dominate the older, stronger and more conservative organizations. The effort to organize becomes more difficult as the product, in this case, labor, becomes less exclusive in its control. It is comparatively easy for skilled men as engineers, printers, and the like to syndicate their issues and monopolize their product, but as the condition of unskillfulness of the common laborer is approached, the difficulty increases, because of the severity of competition. The common laborer is in competition with all mankind, and his ability to enforce restrictions through combinations is nearly *nil*, and generally dependent upon the willingness of skilled labor to support him by sympathetic action. But this has demonstratively proven to be impracticable and unfair. In order to create an enforced scarcity of a certain kind of labor it was necessary that all pertaining to a certain business should stop, and this included 99 that were entirely satisfied in favor of the assistance of the one that was not. It also included all the employers who had striven to be on happy terms with their men, on account of the sins of one who was disposed to be greedy or tyrannical. It also included a condition of chronic strike, because out of so great a mass as constitute the industries of the modern world, there will always be found more or less cause for discontent. The system of sympathetic strikes has fallen from the weight of its own impracticableness.

It is well, however, not to be mistaken in the meaning of this labor movement, in its evolution it develops illegal and injurious phases, for it extends beyond them and includes all productive interests. Capital is striving for precisely the same condition, in much the same way, but not yet with quite the same success from its greater lack of internal discipline The impelling condition is competition carried to the extreme by the tremendous over-development of productive energy due to rapid multiplication of machinery, until market value has ceased to bear any relation to cost. The conditions of human civilized existence have a limit before which the old maxims of political economists must fall. It is clear that society must soon reach some solution of values in their relation to the cost of production, that, in turn rests upon the necessities of living that have no elastic conditions, and leave no alternative. Failing to solve this, society will crumble from the dry rot of anarchy. The instinct that inspired the millers of New York City to recently pool their issues, and that has been productive of numberlesss trusts and syndicates of capitalized industries, is the same instinct that inspires workingmen and artizans to combine in unions to set a price on their labor without regard to the ability of an employer to hire a cheaper man if he could find one. The instinct is right, both in the case of capital and labor,

although in both cases it has been extra legal, and sometimes illegal. Efforts to put down the exercise of this instinct are doomed to certain failure, whether undertaken by all the forces of law or government. The Roman empire broke itself to pieces in trying to subvert a condition of life that natural events had made essential to the European mind. The complete absorption of the elements of life and livelihood by the monkeries and nunneries of the Reformation era, could not prevent its utter overthrow, even when supported by the united armies of the vast empire of Charles V. Neither could Europe prevent the overthrow of medievalism by unity for the destruction of the principles of the French revolution, that Napolean successfully carried through Europe, nor could our own Southern states, although in possession of the arteries of government, prevail against the public sentiment that decreed the downfall of slavery, even although some echoes of it are heard in the Tennessee prison competition, and in the bravoism of Pinkertonism.

SELECTED MISCELLANY.

HOW THEY MOVED OBELISKS.

The obelisks of the Pharaohs are made ot red granite called syenite, says the writer of "Cleopatra's Needle." In the quarries at Syene may yet be seen an unfinished obelisk, still adhering to the native rock, with traces of workmen's tools so clearly seen on its surface that one might suppose they had been suddenly called away and intended soon to return and finish their work. This unfinished obelisk shows the mode in which the ancients separated these immense monoliths from the native rock. In a sharply cut groove marking the boundary of the stone are holes evidently designed for wooden wedges. After these had been firmly driven into the holes, the groove was filled with water. The wedges, gradually absorbing the water, swelled and cracked the granite throughout the length of the groove. The block, once detached from the rock, was pushed forward upon rollers made of the stems of palm trees from the quarries to the edge of the Nile, where it was surrounded by a large timber raft. It lay by the river side until the next inundation of the Nile, when the rising waters floated the raft, and conveyed the obelisk down the stream to the city where it was to be set up. Thousands of willing hands pushed it on rollers up an inclined plane to the front of the temple where it was designed to stand. The pedestal had previously been placed in position and a firm causeway of sand covered with planks led to the top of it. Then, by means of rollers, levers and ropes made of the date palm, the obelisk was gradually hoisted into an upright position. It speaks much for the mechanical accuracy of the Egyptian masons that, so true was the level of the top of the base and the bottom of the long shaft, in no single instance has the obelisk been found to be out of the true perpendicular.

WHAT SUSTAINS THE MOON.

We have read how the coffin of Mohammed was poised without support in the mosque of the faithful, from which all unbelievers were so rigidly excluded; no material support was necessary to sustain the remains of the prophet, the body itself seemed ever on the point of following the departed spirit to the realms of bliss. A perennial miracle was indeed necessary to sustain the revered sarcophagus in space.

The infidel, no doubt, is somewhat skeptical about this marvelous phenomenon, and now, as ever, the truth is stranger than fiction. Far over our heads there is a vast globe larger and heavier than millions of sarcophagi, no material support is rendered to that globe, yet there it is sustained from day to day, from year to year, from century to century.

What is it that prevents the moon falling? That is the question which now lies before us. It is assuredly the case that the earth continually attracts the moon. The effect ot the attraction is not, however, shown in actually drawing the moon closer to the earth, for this, as we have seen, does not happen, but the attraction of the earth keeps the moon from going farther away from the earth than it would otherwise do. Suppose, for instance, that the attraction of the earth were suspended, the moon would no longer follow its orbit, but would start off in a straight line in continuation of the direction in which it was moving at the moment when the earth's action was intercepted.

What Newton did was to show from the circumstances of the moon's distance and movement that it was attracted by the earth with a

force of the same description as that by which the same globe attracted the apple, the difference being that the intensity of the force becomes weaker the greater the distance of the attracted body from the earth. In fact the attraction of the earth on a ton of matter at the distance of the moon would be withstood by an exertion not greater than that which would suffice to sustain about three-quarters of a pound at the surface of the earth.—*Good Words.*

HE OWNED A GRAVEYARD.

The most curious thing about the town of Sweet Springs, W. Va., is the circumstance of a man owning a graveyard. Years ago a man named Herring owned a farm in the south part of town and allowed people to bury their dead in a little plot on the place. As long as he lived graves were dug and people were buried on his farm. After his death a mysterious, unfeeling thing called "the estate" took charge of things. Then it was that people learned that there had never been any cemetery association formed, no deed of the cemetery plot made and that "the estate" owned the whole business. As the town grew more doctors came and the old cemetery could not hold all the people that died. So a large new one was laid out a mile on the other side of town. Some of the bodies were removed, but many had no friends living and were left in the old ground. "The estate" put the old graveyard up at auction and an enterprising citizen bought it—bones, tombstones and all. He is not a vicious, warlike man, neither is he a doctor, and it is not easy to see what he can want of the place, unless with something of the instinct of a shrewd plunger on 'change he is holding it for resurrection day anticipating a great rise in bones. For present profit he turns his horses and hogs into the inclosure to graze and they keep the grass well nipped down, so that only thistles and weeds grow up. Some of the tombstones have fallen. Others are leaning, and it seems like a desolate place with the chickens clucking and scratching around. If Gray could see the place he might write an elegy, although the surroundings would come nearer prompting a phillipic.

WHAT A HORSE CAN DO

A horse will travel 400 yards in 4½ minutes at a walk; 400 yards in two minutes at a trot; 400 in one minute at a gallop. The usual work of a horse is taken at 22,500 pounds raised one foot per minute for eight hours per day. A horse will carry 250 pounds 25 miles per day of eight hours. An average draught horse will draw 1,600 pounds 23 miles per day on a level road, weight of wagon included The average weight of a horse is 1,000 pounds, and his strength is equivalent to that of five men. The greatest amount a horse can pull in a horizontal line is 900 pounds, but he can only do this momentarily; in continued exertion probably half of this is the limit. He attains his growth in five years, will live 25, average 16 years. A horse will live 25 days on water without food, 17 days without eating or drinking; but only five days on solid food without drinking.

ENGRAVING ON STONE.

A revival of interest is to be noted in the application of the well-known sand-blast to engraving on stone, the reason assigned for the exemption heretofore, of this process from such application of the blast being the difficulty of providing a cheap paper material to apply to the stone—one capable of resisting the cutting action of the sand for a sufficient length of time to allow the unprotected portions of the surface to be cut away to the required depth. The prepared paper for this purpose is gummed to the face of the stone, and the design to be outlined on it, after which the outlines are cut away with a sharp-

pointed knife, and the pieces of paper removed which cover those parts of the stone which are to be sunk; the blast is now applied equally over the whole stone, and in cases where a greater depth is required to be cut, the blast is made to act upon those parts for a greater length of time. By this means designs are produced which possess a far greater degree of sharpness in the outlines, including even the most delicate tracery.

BOX ELDER MARBLE.

In the mountains between Cache Valley and Box Elder, Utah, are numerous deposits of great variety. Some of these are entirely worthy of development, but have not been worked in a systematic way, few have been opened np and prepared for market. There is, in this locality, a rare opportunity for the investment of capital, for these marble fields will not long remain untried. A large amount of the marble in our territory is undeveloped on account of the lack of railroad facilities, but it exists in such rich deposits, and is of a quality so fine and substantial that its development cannot for any length of time remain neglected.—*Mining Age.*

UNDERVALUING ARCHITECTS' LABOR.

The Bourse of Philadelphia has earned the hearty disapproval of the architects of that city by its propositions in calling for competitive designs. This building was designed to be one of the most magnificent in the country. Competitive plans were solicited from Philadelphia architects alone, and Professor Ware of Columbia College, was chosen special expert adviser of the building committee. When the call for plans was issued, however, it was discovered that one of the stipulations was that an engineer of construction should be employed by the committee who would practically superintend the building, and to whom the architect would be subservient. Of course this proposition met with immediate disapproval from eminent architects, who felt that if they were to bear the responsibility of constructing so great a building, they ought not to be required to work under the supervision of another employe whose qualifications for the work were entirely unknown. The compensation, also, instead of being fixed at 5 per cent., was placed at two and one-half per cent., a remuneration lower than any architect of reputation can earn in the ordinary course of his profession. The architects proposed mutual concessions to the Bourse committee on these points, but they were given no satisfaction. The result is that out of more than a hundred architects only twelve have presented designs for the building. It is safe to say that none of these are of the capable or distinguished members of the profession, and that the result will be a building improperly constructed, and more money practically wasted than would have paid for the services of the most competent architect in the country. When ability is required in professional service, the best economy is liberal compensation, and the worst extravagance narrow parsimony. —*Architectural and Building News.*

COMPETITIVE ROCK-DRILLS.

Drilling-contests have become deservedly popular among miners and the general public throughout the Rocky Mountain region, and the interest taken in these trials usually brings together many of the best known competitive drillers. At the tournament held at the recent session of the Mining Congress at Helena, the records for both single and double-hand drilling were broken; the former by William Shea, of Montana, with $25\frac{5}{16}$ inches, and the latter by Davy and Tague, also of Montana, with $33\frac{9}{16}$ inches. The rock was granite and the time fifteen minutes in each case. Fifteen teams contested for the double-hand honors, and there were thirteen entries for the single-hand championship. Comparisons between the records made at different contests are somewhat uncertain because of variations in the hardness and toughness of the rocks drilled.—*Engineering Magazine.*

J—*Stone.*

NOTES FROM THE QUARRIES.

The F. G. Clark Bluestone Company, of Norwich, N. Y., are getting ready to move the largest platform stone ever shipped from their quarry. It is 22 feet 3 inches long by 16 feet 8 inches wide, will average 9½ inches in thickness, and weigh about 22¼ tons. A six-wheel truck has been constructed to transport it from the quarry to the depot, where it will be loaded on the special car. In the quarry is another block cut that, when split, will make two platforms the size of the above.

The Allegheny quarries at Lancaster, O., of which Frank C. Neeb, formerly a Pittsburgh journalist, is owner, are now working a large force of men. A contractor from Columbus, O., is superintending the quarrying of the stone, which is cut and ready to place in position when it leaves Lancaster. This stone is to be used in the construction of the Columbus viaduct. Mr. Neeb will supply two-thirds of the stone used. The agreement is said to be the largest masonry contract let in the state of Ohio.

The court-house contractors have been waiting a year for the large stone for the front steps of the new court-house. It weighs 70,000 pounds and the work of two men for a year will be required in trimming it. When finished the stone will be 15 feet 5½ inches by 13 feet 1 inch in size and 18 inches thick. Some of the spalls were large enough to make curb stones, and the chips off the great rock will load two wagons. It took eight horses to haul the stone, and the tires of the wagon were about a foot wide. The stone came from the Ortonville granite quarries of Baxter & Son, and it will lay for years, perhaps centuries, to be trodden upon by the feet of children yet unborn. It will be worn smooth by billions of heels, and when Minneapolis has a million inhabitants, when the astronomers will have definitely settled that Mars is inhabited, when Edward Bellamy's nationalism will have been tried and found wanting, and when Ignatius Donnelly doesn't want an office, that rock will be there.—*Minneapolis Tribune.*

A dressed stone 71 feet long, 13 feet wide and containing 12,922 cubic feet, has rested on pillars in a quarry at Baalbac, in Syria, for more than 2,000 years. It was intended for the foundation of the Temple of the Sun, a mile or more distant, to which four stones nearly as large were actually transported.

The Turkey Honestone Company, Denver, Colo, is working a force of fifteen men at its quarries, and has placed in position the machinery for taking out the honestone to the amount of $5,000. They are taking out four ton of stone a week, and so great is the demand that the company is unable to fill its orders. The present machinery and working force may be doubled as soon as the quarry is in shape to work an increased force. The stone has been channeled out to a depth of 30 feet and is found to be of the genuine marine formation, free from flaws and contiuous in quality. It is estimated the deposit is 150 feet in depth, and the company own three-fourths of a mile along the deposit.

The quarries of Jacksonville, Mich., have uncoved and quarried all the stone that they can ship this season, and the work of covering the quarries and protecting the stone against frost will soon begin. Some of the oldest quarries have but a couple of seasons' shipments left in the ground, but the new quarries which have been opened and tested will undoubtedly furnish all the stone the market needs.

Much has been written concerning Provo slate, slate quarries and Slate Cañon, Utah. It will be remembered that it has been reported that two slate quarrymen came to Provo and went to work for F. W. C. Hathenbuck, on his slate quarries some two years ago. They

further up the cañon and located a ledge
iemselves. This location they have per-
itly developed and this spring sold an un-
ed half interest to Elias Morris, of Salt
City, and others, for big a sum, and imme-
ly thereafter the Bethesda Slate Company
ncoporated for $100,000, with Elias Morris
dent, and John W. Thomas, vice-president.
company has been working quietly, but
stently, and have now out upon the dump
rds of a carload of slate ready for the
et, besides much more in the rough. the
to the quarry is completed. The slate is
t present by hand, but machinery is on the
ind will soon be in place at the quarries.

iew granite quarry is being opened in Rich-
l, Me., by Stephen Reed. Several pieces
been sent to Quincy to be polished and
rial for a monument is to be sent at
to Bath. Mr. Reed, who is an experienced
yman, states that it is superior to Quincy
te in every respect. It is entirely free
iron, and is especially adapted for monu-
al work. He sees no reason why a crew
o should not be employed the year round.
cksmith shop is to be erected near the
y right away and the work of getting
imension stuff is to be pushed along as
ly as possible.

yx of superior grade has been uncovered
e Turkey creek hog-back, in Colorado,
n estimate made as to the extent of the
iit, which possesses all the rich coloring
beautiful tracery of the Mexican article,
i is exclusively used in the United States
nterior decoration. Onyx works have
established in Denver.—*Mining and Sci-
c Review.*

: Roxbury Granite Company is develop-
i Keene, N. H., what promises to be one
: finest ledges in New England. A stone
ecently quarried with wedges alone 78
ong, 7 feet 2 inches wide, 4 feet thick and
iing, by estimate from measure, 220 tons.
vithout seam or stain, and splits as if cut
i saw. The quality of granite is unsur-
d, and no dynamite or powder is used in
iarrying.

: quarry opened in the Moses Morse pas-
Franklin, N. H., by Peter Dana and
s. Trussell and Quimby, of Concord, is
ng a quality of product very satisfactory,
being equal to Concord granite. The force of hands will be increased and there are indications that it will soon be a busy place.

The Plymouth Granite Company, at Waterbury, Conn., has increased its capital stock from $5,000 to $10,000.

The stone industry of Carthage, Mo., continues to grow in fine shape, with constantly increasing outputs and shipments.

The Superior, Wis., Cut-Stone Company is furnishing the stone for the Weymss building at Superior.

The spur to the marble quarry, Humboldt, Kan., is being built now, and soon Iola marble will be shipped to outside points for building and other purpose.

Vinalhaven, Me., is to have a new development of its granite industry. There has been discovered at Coomb's Neck the only sheet black quarry as yet known. The rock is very fine grain. Samples have been polished and sent to Washington, where it has received much attention and many compliments. Iron, which renders almost useless so much of the black granite, does not appear in this, which makes it much more valuable. The quarry is easy of access, and a wharf can be built at a very slight cost, as the water is very bold, and a splendid harbor makes it safe for vessels to lie there at all times.

The Lake Superior Redstone Company, at Portage Entry, Mich., has commenced the shipping of building stone from the newly-opened quarries. The stone is of excellent quality, and is expected to find a ready sale. Marquette capitalists are largely interested in the business.

The Tempe redstone quarries, at Phœnix, Ariz., it is said, will be worked on an extensive scale next year.

A few days ago we were shown some very fine specimens of marble that had been discovered near town by a prospector. Some parties who saw it were of the opinion that it was gypsum, but an examination proved it was genuine marble. The samples had faces ground and polished and looked very fine. The color was a very dark mottled brown, while a test proved it was too hard for gypsum and too

soft for granite, and in addition the color was entirely too dark for either. There will be some larger pieces brought in before many days.

The Michigan Stone and Supply Company, of Monroe, Mich., has doubled its working force of men and is working day and night to supply the demand for its crushed stone.

The Detroit and Lake Superior Sandstone Co., (limited), with a capital of $500,000, filed articles of association with the register of deeds at Detroit, recently. H. W. Moore, Henry Wineman, Edward N. Hays and William R. Johnson, of Detroit, and Richard Blake, of Marquette, are the incorporators, with Mr. Moore as president, and Mr. Johnson secretary and treasurer. The company owns five acres of sandstone on the shore of Lake Superior, 30 miles above Marquette.

All the stone quarries in the vicinity of Harrisburg, Pa., within a distance of from four to eight miles, have been tested in their largest outputs this season, the demand for the material being larger than for years before. Orders for supplies of broken stone to ballast road-beds for electric motor railroad tracks constitute a demand for it, while the increase of need for stone is unusually large this season. It has often been a matter of surprise that many of these quarries have not long since been exhauted.

The people of Lawrence county, Pennsylvania, are protesting against the employment of Italians in the quarries. There is hardly a session of court when there are not several Italians to be tried for all sorts of offenses from simple assault to murder. They are said to work for less than $1 a day, to the detriment of Americans who cannot live on such a sum, and they pay no taxes, yet cost the country more in a criminal way than any other people. The state of affairs is blamed on the immigration laws, and a change is demanded.

Z. Fielder pays daily visits to his lithograph quarries south of Hannibal, Mo., and that the stone is there in paying quantities there is no longer any doubt.

Captain Trowell, of the American Verde Antique Marble Company, was in Marquette, Mich., recently. The stripping at the quarry, which is located about six miles west of Ishpeming, has progressed to an extent that allows of cutting and taking out stone from now on.

At Decatur, Ind., A. J. Chapman was struck by a derrick hook in a stone quarry and his neck was broken.

The Terre Haute Stone Works, located at Stinesville, Ind., and supplied by one of oldest and best-known stone quarries of the state, has been bought by William Lily, representative of Pennsylvania capitalists. The price paid was $50.000.

J. T. Wyatt, of Salisbury, N. C., who owns and operates granite quarries in that section, and who is now supplying therefrom rubble for the streets of Richmond, Va., advertises for a partner.

RECENT PATFNTS.

No. 474'142 is an Improved Derrick invented by Augustus Myers, of Toronto, Can. The object of the invention is to arrange a derrick by which stone or other heavy objects may be moved from one point to another practically without manual labor; and it consists in the peculiar construction, arrangement, and combinatiors of parts hereinafter described A represents the mast of the derrick, the bottom of which rests in and is fixed to the shoe B. On each side of the shoe B, is formed a flange C, to which flange a cross-timber D is securely

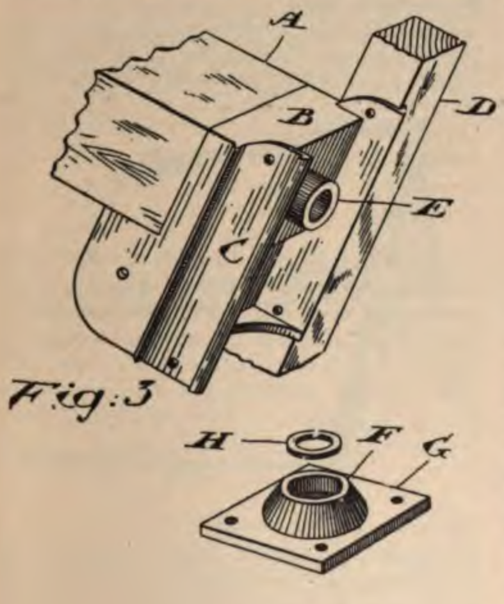


Fig:3

Fig.4

fastened. A hub E is formed on and projects from the shoe B. (See Fig. 4.) This hub E is made to fit into an annular recess made in the projection F, formed on the step G, which rests on and is securely bolted to a suitable foundation. A steel washer H is fitted into the recess formed in the projecting F and supports the hub E. From this description it will be seen that the mast A may be revolved in either direction by the action of the rope L, and that a heavy object upon the boom K may be moved from one point to another without any manual labor.

Patent No. 475,350.—Drawing-Board. Richard G. Shiley, Marietta, Ohio. Filed Mar. 31, 1892. Issued May 24, 1892.

CLAIM.—1. In a drawing-board, the combination, with the board, of two curved side springs located at opposite sides of the board, two double arms pivoted to stationary supports on each inner side of the frame-pieces 1 and 1*a*

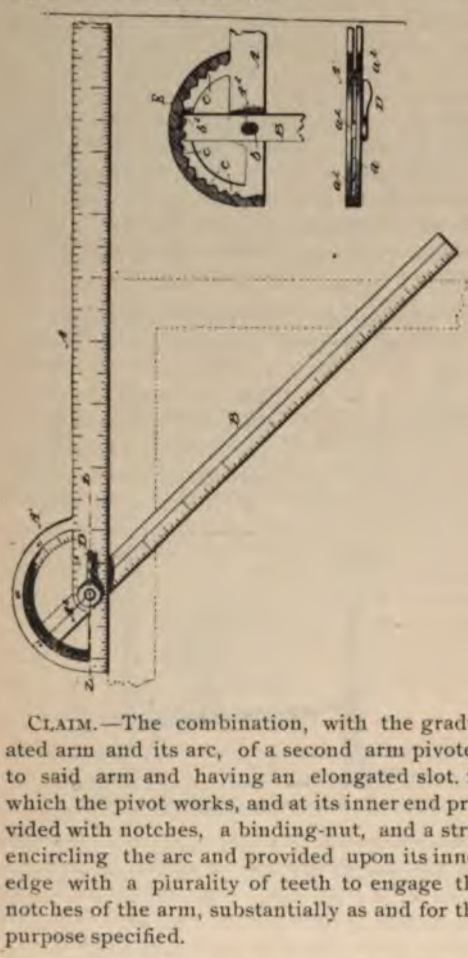
connecting-rods pivotally connecting the ends of the longer portions of said arms with the ends of the springs, rods mounted on the frame having right and left hand screw portions which pass through correspondingly-screw-threaded blocks pivoted to the ends of the shorter portions of said arms, a means for turning said rods, and a means for preventing the rods from moving longitudinally.

2. The combination, with the board, of a removable portion 24, an adjustable sliding piece 25*a*, carrying the point 25, and a means for adjusting it to any desired point on the side of the board and securing it thereto.

3. The combination of the board, its side springs 14, the operating-arms pivotally connected with said springs, a means for giving them their necessary movements, and a curved

graduated index-bar for indicating the point of sight.

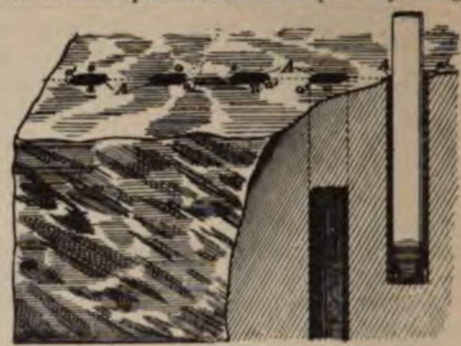
Patent No. 475,390. Bevel and Try Square. Silas C. Downey, Chicago, Ill., assignor of one-half to Richards & Rutihauser. Filed Nov. 19, 1891. Issued May 24, 1892.



CLAIM.—The combination, with the graduated arm and its arc, of a second arm pivoted to said arm and having an elongated slot. in which the pivot works, and at its inner end provided with notches, a binding-nut, and a strip encircling the arc and provided upon its inner edge with a plurality of teeth to engage the notches of the arm, substantially as and for the purpose specified.

Patent No. 475,647. Method of splitting rock. George L. Weller, Elyria, Ohio, assignor to Parks Foster and Eugene K. Mussey, same place. Filed Nov. 23, 1891. Issued May 24, 1892.

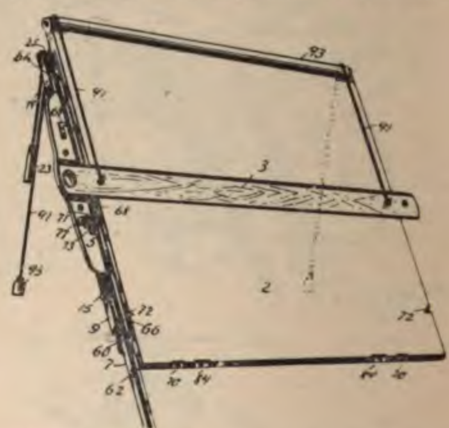
CLAIM.—1. The method of splitting rock, which consists in forming in said rock a hole having V-shaped ends and sides which are parallel to each other and to a plane passing through the points of said V-shaped ends, and then firing a blast in said hole; in forming in said rock in alignment a series of holes, each having V-shaped ends and sides which are parallel to and equidistant from a plane passing



through the points of all of said V-shaped ends, and simultaneously exploding a blast in all of said holes, for the purpose specified.

This invention, No. 475,741, relates to improvements in T-squares and guides thereto; patented May 24, 1892, by Arthur P. Page, Minneapolis, Minn.

The objects in view are to provide an improved T-square which can be readily and easily adjusted to any desired position on the draw-



ing-board with which it is used and the blade of which can quickly be adjusted to the desired angle with the head or can be removed and used as a ruling-edge independently of the head; also, to remove the construction of the square in several particulars to produce a more convenient and durable instrument.

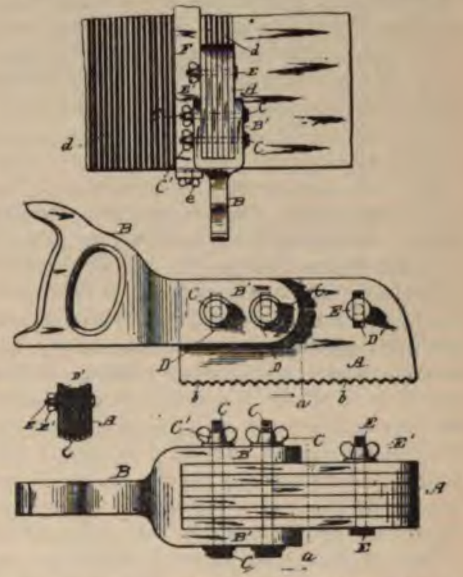
Patent No. 477,017. Stone-dressing hammer. George McDonald, Troy, N. Y. Filed July 3, 1891. Issued June 14, 1892.

CLAIM.—1. In a stone-hammer, a hammer.

head composed of a plurality of blades severally beveled or sharpened at each end and detachably bound together by two screw-threaded bolts, each bolt passing through an elongated washer extending transversely across the outer blade on one side of the head through the several blades and secured to a similar washer or nut on the opposite side of the head; 2. In a stone-hammer, the combination of a handle having an eye at one end, blades situated in said eye and having bolt-holes suitably located, washers abutting against each edge of each side wall of the eye and resting on the blades, and screw-bolts passing through each pair of washers and through the blades, whereby said blades are bolted together and to the washers and the latter are held solidly against each edge of each side wall of the eye, substantially as set forth.

Patent No. 477,693. Hand implement for tooling stone-surfaces. William F. Nicholson, Worcester, Mass. Filed Feb. 17, 1892. Issued June 28, 1892.

CLAIM.—A hand implement for tooling stone-surfaces, comprising the series of blades A, placed side by side, and having curved teeth or cutting-edges on the bottom coming in line transversely, as described, and also having vertical slots extending transversely through all the blades, in combination with a suitable handle B, adapted to receive one end of the blades when bunched together, and suitable



bolts and nuts for fastening the parts after adjustment, substantially as shown and specified.

The Watts monument, which it has taken the Henry-Bonnard Bronze Company eight months to cast, has been placed on exhibition at the company's works, at Yonkers, N. Y. The monument, which is to be erected in about four weeks in memory of John Watts, founder of the Leak and Watts Orphan Asylum, is of one piece of bronze, and cost $15,000. It is 9 feet and 3 inches in height.

The New York Granite Co., of 67 West 23d street, New York City, reports business better than expected, considering the drawbacks encountered by all granite dealers of late. Until a settlement of existing troubles is effected they do not expect to see as healthy and confident conditions as would otherwise prevail.

Three of the largest flagstones ever brought to the tri-cities has recently been received in Moline, Ill. They are for the floor of a porch at C. H. Deere's residence, and are each 10 feet 6 inches long, 6 feet 10 inches wide and 8 inches thick.

There now seems to be a fair prospect of the early completion of the monument to be erected at Troy, N. Y., to the memory of the late Chief Engineer J. Lansing Lane. C. H. Conards, of Hartford, Conn., the sculptor who has charge of the work, made an excellent clay cast of the bust of the dead chief. He obtained, after many trials and changes suggested by Chief Lane's intimate friends and relatives, an excellent likeness, which will be cut in stone.

BOOKS AND PERIODICALS.

The September *Californian* is a striking issue. It contains a sensational exposé of spirit photography, from the pen of the well-known scientist, Dr. Elliott Coues, of the Smithsonian Institution. Dr. Coues slashes the bogus spirit photographers without mercy, and makes most entertaining reading—having traced down all the fraudulent pictures. The pictures to this paper are striking and will create consternation in the army of frauds who prey upon unsuspecting people. A timely and beautifully illustrated article is on yachting about San Francisco, by Mr. Yale, editor of the *Mining Review*, a well-known yachtsman, and authority in such matters. The illustrations are racy and numerous, being instantaneous views of every famous yacht on the bay. A remarkable exposé of a secret society in Honolulu in which superstition ran mad, is found in the illustrated article entitled "Black Art in Hawaii," by the Rev. Dr. Fisher, a former missionary. Higher education in California is well illustrated in a well-written article on Throop University. Auguste Wey, a brilliant writer, continues the series on what California can do at the world's fair, and a plea for the missions is made in behalf of the Society for the Preservation of the Missions by Mrs. Powers, the illustrations being by Fenn, showing San Luis Rey and the old mission of San Diego. Among the articles on foreign subjects is an entertaining one on India, by the well-known author and scientist, Dr. Simms. Richard H. McDonald Jr., the well-known San Francisco banker and political economist, makes an earnest plea for reform in a scholarly paper on "How to Secure Good Municipal Government." No question is of more importance to California than that of the Nicaragua Canal, and the third in the series of papers, by W. L. Merry is given, treating the financial side of the question with ability. Stories by Mrs. Bugeia and Dorothea Lummis, poems, book reviews and discussions of questions of the day by ex-Gov. Lionel A. Sheldon, make up a number of especial interest. Published in San Francisco; $3 a year.

"Where to Locate New Factories" is the title of a 150-page pamphlet recently published by the Passenger Department of the Illinois Central railroad, and should be read by every mechanic, capitalist and manufacturer. It describes in detail the manufacturing advantages of the principal cities and towns on the line of the Southern Division of the Illinois Central and the Louisville, New Orleans & Texas railroads, and indicates the character and amount of substantial aid each city or town is willing to contribute. It furnishes conclusive proof that the South possesses advantages for the establishment of every kind of factory working wool, cotton, wood or clay. For a free copy of this illustrated pamphlet address Mr. J. F. Merry, Assistant General Passenger Agent, I. C. R. R., Manchester, Iowa.

"STONE" probably numbers more amateur photographers among its constituency than any other industrial journal extant, outside of photographic publications, due doubtless, to the fact that its readers are engaged in the creation of that which is in one sense or another, artistic. We have taken occasion, therefore, to frequently notice photographic journals sent us to the end that those interested may become acquainted with those best adapted to their needs. Edward L. Wilson, the author of many valuable works on photography, of which the "Quarter Century of Photography" is one, publishes *Wilson's Photographic Magazine*, a publication now in its 29th year and giving promise of some very interesting features for the coming year. It issues semi-monthly from New York at $5 per annum.

The *American Journal of Photography* has much to sustain its claim of being "devoted to photography in its widest sense." The number before us contains matter of interest to every

from "raw recruit" up. Thos. H. McCol- Co., Philadelphia, are its publishers, and ys for a year's subscription.

as. W. Melcher Machinery Co., of St. Louis, pliments STONE with a copy of the "Pocket enir and Program of Fall Festivities, Fair Exposition," now being held in that city. little book is a guide to the town, and is of interesting information to any one in- ted in St. Louis at this particular time. do say no other city in America spreads half so well in offering pleasing entertain- to visitors as does St. Louis in the annual estivities. It's a good place to go to at ime to shake off the lethargy of summer's ence and get primed up for the winter's aign of active business. The show will be open from Sept. 7 to Oct. 22.

have received from the publishers, "True ' Republican Campaign Songs, and "Red Democratic Campaign Songs—two books, containing a collection of new songs ar- ed for male quartet clubs, with music and s complete, and just what is wanted for presidential campaign of 1892. Nothing ore effective than stirring and appropriate s for campaign purposes, and they are shed in great variety in "True Blue" and l Hot." Sold by music and news dealers rally, or upon receipt of ten cents each, s will be mailed to any address by the S. ard's Sons Co., Chicago, Ill.

ting for September is as refreshing and hful in influence as the first pure breeze ave old Autumn. The reading matter as l, mainly devoted to sport, pastime and l, is most interesting, and the illustrations, always a strong feature of *Outing*, are better than usual. The contents are as follows: "Saddle and Sentiment," (continued), by Wenona Gilman; "How We Went Blundering," by Jean Porter Rudd; "The Griswold Mystery," by Om. Hinckley; "Hammer Throwing," by Malcolm W. Ford; "Shore-bird Shooting in New England," by H. Prescott Beach; "Harry's Career at Yale," (continued), by Jno. Seymour Wood; "From the German Ocean to the Black Sea," (concluded), by Thomas Stevens; "Reminiscences of Irish Sport;" "Military Schools of the United States," (concluded), by Lieut. W. R. Hamilton, U. S. A.; "September Rides," by Jessie F. O'Donnell; "Around the World with Wheel and Camera," (continued), by Frank G. Lenz; "Fishing a la Tourilli," by N. B. Winston, and the usual editorials, poems, records, etc.

The August number of the *Review of Reviews* contains a character sketch of Mr. Grover Cleveland, written by a gentleman whose qualifications are admittedly the very best. Mr. George F. Parker, who has recently edited Mr. Cleveland's speeches, official messages and other utterances, gives a sympathetic and eulogistic, but careful and candid, sketch of the distinguished standard-bearer of the Democratic party. This August number is particularly interesting. One of its keenest articles is a sharp, and very unsparing attack upon "Cahenslyism," by a prominent American Catholic editor. There are articles upon University Education for Women; "How to Learn a Language in Six Months" "Coöperative Holiday Traveling" The leading articles of the month sum up the principal political, social, religious and literary utterances and achievements of the past few weeks.

LEGAL NEWS AND NOTES.

Prepared for STONE, by V. H. Lockwood, Indianapolis.

DRAWER'S LIABILITY ON CERTIFIED CHECK.—In Head v. Hornblower, the Supreme Judicial Court of Massachusetts, held that where a bank upon which a check is drawn fails before payment thereof, though it is drawn in due season, and the drawer of the check in his own behalf, or for his own benefit, had the check certified before delivering it to the payee, he is not discharged from liability on the check, but he is discharged, if the payee or holder of the check for the latter's benefit got the check certified instead of getting it paid.

GOVERNMENT FIXING RAILROAD FREIGHT CHARGES.—A very important decision has been rendered by Judge McCormick of the United States Supreme Court for the District of Texas. Decisions of the United States Supreme Court previous to the well known "Minnesota Granger Case" seemed to sustain the doctrine that the adjustment of rates to be charged by a railroad company was a legislative prerogative and not a judicial one. In the "Minnesota Granger Case," however, it was held that the state had not the power, by acting through commissioners, to fix the rates absolutely and finally without judicial inquiries as to their reasonableness. This was evidently an eminently sound and proper conclusion, whether it was in reality a departure from the previous decisions of the courts or not. Judge McCormick, in the recent case, following the "Minnesota Granger Case," denies the assumed power of the state legislature to regulate the rates of freight and fare through the mediumship of boards of railroad commissioners, if by such regulation the rates are made so low that the company cannot pay its own debts. Such regulation is held to be a law impairing the obligation of contracts, and, therefore, unconstitutional.

The supreme court of the United States has held that the legislature can fix the rates and charges, whether reasonable or not, and that the reasonableness of the rates so fixed by the legislature is not subject to judicial inquiry. Such inquiry, therefore, is required only when a commission is authorized to fix the rates.

RULES MADE BY CARRIERS FOR THE GUIDANCE OF SHIPPERS.—The case of Miller v. Georgia Railroad & Banking Co. is a recent one bearing upon the discussion of the power of railroad companies, common carriers, and terminal associations to make rules and regulations for the guidance and government of shippers.

The exact point decided by the Georgia Court in this case, is that it is competent for a common carrier whose customers, at their option, have the privilege of unloading for themselves the vehicles in which their freights are shipped, to adopt and enforce reasonable regulations as to the time within which the vehicles may be unloaded free of any expense for storage, and to fix a reasonable rate per day at which storage thereafter will be charged for the use of such vehicles so long as they remain unloaded; and that a rate of one dollar per day for each railroad car thus devoted to the use of storing freight is not necessarily unreasonable on the alleged ground that the cars are of different sizes and vary in capacity, nor that a fraction of a day is charged for as a whole day, nor that the customary rate of storage in warehouses or elevators is much lower, nor is it as a matter of law unreasonable for any cause.

CONTRACT BY TELEPHONE.—In Oskamp v. Gadsden, decided in the supreme court of Nebraska, the defendant telephoned from Schuyler to the plaintiff in Omaha. One of the plaintiffs answered the call, but owing to the atmosphere the parties were unable to communicate directly with each other. The telephone operator at Fremont, an intermediate station, proceeded to and did transmit the defendant's message to the plaintiffs offering to sell them a a quantity of hay and repeat to the defendant, plaintiff's answer accepting the proposition. In an action for breach of contract it was held that the conversation was admissible in evidence, and that it was competent for the defendant to state the contents of plaintiff's answer to his message as repeated by the intermediate operator at the time it came over

res. It was held that the intermediate or at Fremont was not the agent of the lant alone in telephoning, but she was laintiffs' agent in repeating their answer efendant's message, and that telephone rsations were admissible as evidence of ract in proper cases.

ENT CASES RELATING TO SALES.—In the f Tootle v. First National Bank, decided supreme court of Nebraska, it was held hen goods are sold upon credit induced fraudulent representations of the pur- as to his financial ability, the vendor escind the contract within a reasonable fter the discovery of the fraud, upon a re- f, or offer to return, the consideration re- by him, and reclaiming the goods as t any one not a bona fide purchaser for without notice of the fraud.

he case of Mayhew v. Mather, decided in preme court of Wisconsin, the defendant ased goods of the plaintiff, led him to be- hat he was buying as the agent of a cer- rm, but in reality for himself. Plaintiff, ut full knowledge of the facts, cashed the lant's check, given in payment of the bal- which defendant said was due on the pur- Held, that a tender back by plaintiff of nount to defendant upon hearing of his resold as principal to a third person, st prior to his bringing replevin for the against defendant and the purchaser, is sion of the sale.

e case of Smith v. Evans, decided in the ne court of South Carolina, the defend- as indebted to the plaintiff, and pointed ree bales of cotton, lying some distance two of which bales he said should be l over to plaintiff on the account. The greed on was ten cents per pound. The had not been weighed, but was to be ed on delivery by defendant at plaintiff's and the amount ascertained credited on count. The value of the two bales was $75. It was held that in an action for covery of the cotton there was not such ery as would take the case out of the of frauds.

he case of Campbell v. Ehlen, decided in preme court of Maryland, coal was sold intiff to defendant with the stipulation was to be delivered on board defendant's vessel. No special time was fixed for delivery, but plaintiff agreed to load as quickly as possi- ble, which he did. The vessel master, upon arrival at another port, filed a libel in admiralty against the cargo for demurrage, and in this proceeding, of which plaintiff received notice, the coal was sold. It was held that by delivery on board, the title to the coal passed entirely from plaintiff, and the admiralty proceeding, being against another's property, could not affect his right to recover in an action for the purchase price.

CONNECTING CARRIERS OR TRANSPORTATION LINES.—The general rule in the United States is that where goods are received for transpor- tation to a point beyond a carrier's own line, his duty is to carry them over his own line and to deliver them safely to the next connecting carrier, and he is not liable for any loss occur- ring beyond his line, unless he has agreed to be so liable.

But in Alabama, Florida, Georgia, Illinois, Iowa, Kentucky, Missouri, New Hampshire and Tennessee, in such cases, the carriers' duty is to see that the goods go through and are de- livered to the consignee, and he is liable for any loss occurring to the end of the entire trip, whether it be on his or on connecting lines, un- less the consignor has agreed not to hold him so liable.

A contract for through transportation may be made by the carrier who receives the goods, and such a contract will render him liable for failure to deliver the goods at the other end within a reasonable time. If he agrees to d liver them by a certain time, he must keep his contract, whether the delay be due to other lines or not.

A contract for through transportion may be inferred from the meaning of the destination in the bill of lading, from the receipt of the entire freight, or from other circumstances. It may be also verbal.

A contract to ship through renders all con- necting carriers jointly liable for all loss due to the negligence of any one connecting line and its servants; and a clause in such a contract stating that the receiving carrier will not be liable for loss beyond his line will be void. He has agreed to ship through and he must do it as if his own line extended to the point of des- tination. The connecting lines in such a case are merely his agents.

PUBLISHER'S ANNOUNCEMENTS.

A PROSPEROUS GRANITE COMPANY.

The Stanstead Granite Company, of Stanstead Junction, P. Q., and Beebe Plain, Vt., report a rapidly increasing business necessitating the employment of more workmen and additional machinery. They have also added to their firm as a partner, Mr. John O'Rourke, of Barre, Vt., who is well known to the trade. Mr. O'Rourke will have the sole management of the manufacturing department and this they trust will be a guarantee that first-class workmanship and prompt shipping may be relied upon.

"CONFIDENCE BEGETS CONFIDENCE."

When John W. Philpott, of Cleveland, O., tells quarrymen that he is so confident of having the best channeler spring the world produces, that he is willing to send it on a three months' guarantee, he captures their trade at once. He says that all of the quarries in the vicinity of Cleveland buy his spring and like it. New orders are coming from a distance and in order to increase the number of these he is announcing his wares in the advertising pages of STONE in a unique manner. The hose sold by him for use on steam drills is noted for its lasting qualities.

Lord, Bowler & Co., Cleveland, O., report an active demand for their specialties. One advantage offered by this firm is, that having no agents, their customers can be assured of low prices on all work and machinery ordered direct. It would pay to correspond with them.

Business with Charles Clements & Co., granite dealers, Boston and Chicago, has been very good considering the prolonged strike. They report only a few orders that are much behind in American granite and if labor troubles are settled soon, it will only be a short time until they are caught up. They have had but very little delay in their orders for Scotch and Swede granites, statuary and building columns. A great many orders in foreign material have been shipped ahead of time agreed upon They aim to give their what the customers order, and make no unreasonable promises simply to obtain orders. They wish to say to all readers of STONE, send to them for estimates on your work, in all American and foreign granites, granite and marble statuary and think they can interest you.

The Virginia Brownstone Co., of Hinton, W. Va., reports business brisk and likely to continue so during the fall. It is furnishing the rough and sawed stone for the Old Dominion National Bank building and Col. Braxton's business block at Newport News, besides many smaller buildings. They have been having a lively trade in Washington, D. C., as well as other cities East and West.

The favorable opinion of STONE as expressed in the August issue by Messrs. Parker, Melcher & Ingraham, of Chicago, has been sustained by their patronage of its advertising department. When the personnel of this newly-incorporated concern is made known to our readers it will be readily perceived that they are not new to the trade. Mr. Parker, the president of the company, was formerly representative of the Ingersoll-Sergeant Drill Co. with headquarters at Marquette, Mich.; Mr. Melcher, secretary and treasurer, is of St. Louis, where he still continues at the head of the prosperous company incorporated in his name; Mr. Edgar Ingraham, vice-president, requires no introduction to the patrons of the Ingersoll-Sergeant Rock Drill Co., having been identified with the company for several years, with headquarters at various points in the United States and Canada. The formation of this company was due largely to the increase af trade acquired by the Ingersoll-Sergeant Drill Co. in the West, and it is pleasing to note that those who have contributed to the success of the parent company have had their fidelity rewarded by the absolute control of its Western business. Messrs. Parker, Melcher & Ingraham have a very complete establishment at 100-104 West Washington street, Chicago, well lighted and conveniently arranged. Quarry owners visiting Chicago will be accorded a very cordial welcome there, and be shown all that is modern in the line of machinery and supplies.

The Georgia Marble Co., of Tate, Pickens county, Ga., makes some very strong claims for its product in the full-page advertisement on page 13, and as these claims are sustained by no less competent authority than Prof. Geo. P. Merrill, in his article on "The Building-Stone Industry of the United States," it would ap-

reasonable that credence be given them. nportant feature of their business is the ugh manner in which they are enabled rk out details and the prompt attention to estimates should insure favorable conation from those who have important jobs t.

———

& Sembower, of Chicago, invite stone icers to send for their illustrated catalogue iptive of their hoisting engines, horizonnd vertical engines and boilers. This rn does a very large business in the West njoys the reputation of taking excellent of orders intrusted to it.

———

e safest and strongest explosives are the always. More damage to the rock and accidents to workman can be attributed use of poor explosives than from any cause in quarrying. The best is always afest and cheapest. In this connection ould advise our friend, the quarryman, rrespond with the Ætna Powder Co., of go, whose explosives and blasting appliare used everywhere with the highest action.

NTED—Marble-cutters. DAVIDSON & SONS, Foot North Market street, Chicago.

WANTED—General workman and two cutters. Good wages and steady work. A. BLACK & SON, Hastings, Mich.

WANTED—A thoroughly competent marble workman to take charge of marble shop: must be in possession of first-class references. Address P. O. Box 281, Gettysburg, Adams county, Pa.

WANTED, SITUATION—As forem n, to take charge of stone cutti g by an experienced, sober, honest man. Twelve years' experience in quarrying and cutting. Can furnish reference. Address C. H. W., care of STONE.

FOR SALE.—The best quarry of red sandstone in Colorado. Unlimited quantity of stone, good trade most excellent shipping facilities, equipped with latest improved machinery. Address, SNIDER STONE & LIME Co., Maniton, Colo.

FOR SALE—A tract of 160 acres of extra fine oolitic land, located one mile south of Bloominton, and one-half mile from L. N. A. & C. railway track. Stone has been fully tested, core drilled, and have begun stripping quarry; channeling to begin soon. Will sell in tracts of 20 acres more or less. S. C. DODDS, Bloomington, Ind.

WANTED, SITUATION—By practical man in marble and granite cemetery work, and any class of building-stone work. Posted in every department of stone-work; 45 years of age; 25 years' experience; 19 years as foreman, etc.; very best references as to ability and reliability; strictly temperate and steady; permanency at reasonable pay preferred. Address S. C. BRINK, Independence, Ky.

QUARRY MACHINERY IN GOOD ORDER.

1 Lidgerwood Single-Hoist Engine with Boiler.
2 Lidgerwood Double Hoist Engines with Boilers.
1 Ingersoll Rock Drill, good as new.
Close prices on applicati n.

W. H. GIBBES JR., & CO.,
Engineers, Dealers and Contractors, COLUMBIA, S. C.

F. WINTHROP PHILLIPS,

DESIGNER OF

VAULTS AND MONUMENTS,

82 ABORN-ST., PROVIDENCE, R. I.

CHANNON CO., 22 to 26 Market-st., Chicago, Ill.,

Importers and Dealers in

IGLISH CRUCIBLE & PLOUGH STEEL CABLES

coal Iron Rope, Galvanized Iron Cable, Manila Rope and Blocks for Wire and Manila Rope.

MONUMENTAL NOTES.

On Eighteenth street, Chicago, near the palatial residence of George W. Pullman, stands a dead tree. It marks a notable spot in local history, for here is the site of the massacre of the garrison of old Fort Dearborn in 1812. Upon this spot Mr. Pullman will erect a monument. The statue will cost $30,000, and the designer, Carl Rohl Smith, will depict the tragedy after the evacuation of the old fort. The pedestal will be of granite ten feet high. Each side will have a bronze tablet on which will be represented incidents of the massacre. Mr. Pullman is known to every one as the sleeping-car king, and his fortune is estimated at thirty or forty million dollars.

The excursion of the Italian residents of Baltimore to Avondale netted quite a neat sum for the fund to erect a Columbus monument in that city. There were at least 1,000 people on the ground, but such ample preparations had been made that all were fully accommodated. The credit of this was due wholly to the committee of arrangements, which included Alexander Cutin, chairman; G. Salvi, A. Carmilli, F. Campaggi, S. DePaoli, L. Viols, D. Carollo, and D. Miccio. Among the most zealous of those working to secure the fund for the monument is Mr. Pipitone.

Peter Baufle, of Tunnelton, O., near Mitchell, Ind., was cutting a monument for his own grave, and dropped dead from heart disease while on his way to work on it.

The proposal to erect a soldiers' monument in Canton, O., is so praiseworthy that it would seem no opposition to it could be found. The dead soldiers deserve this recognition.

According to French papers arrangements are about completed for the erection of a monument to Theophrast Renaudot, the founder of journalism in France. The Paris council and the council of the Seine department have money for the purpose. Jules Claretie is the chairman of the committee which has the project in charge, and Alfred Beucher has been chosen as sculptor. Theophrast Renaudet, who is to be honored, was born in London in 1575. He studied medicine. After practicing his profession for a time in his native place he was called to Paris by Cardinal Richelieu in 1625. There he estalished labor bureaus, loan houses, free hospitals and other institutions which made him popular among all classes of the people. On May 30, 1631, Louis XII gave him the "privilege of printing and selling the news and stories of what has happened and what may happen in and outside of the kingdom." The first *Gazette* appeared on the evening the same day. The future monument is to adorn the Flower market, where the former editor once had his office.

An interesting ceremony took place at Lucerne on a recent Sunday, when the 100th anniversary of the massacre of the Swiss guards at the Tuilleries was celebrated. Every visitor to Lucerne knows the famous monument (the Lowendenkmal) executed in the living rock from Thorwaldsen's design. It represents a lion of colossal size, wounded to death, with a spear in his side, yet endeavoring in his last gasp to protect from injury a shield bearing the fleur-de-lys of the Bourbons, which he holds in his paws. Though the centenary was celebrated on Sunday, the 7th, the actual massacre look place on Aug. 10, 1792. "We are Swiss, and the Swiss never surrender their arms but with their lives," were the proud words said to have been used by the Swiss mercenaries. "*Helvetiorum fidei ac virtuti*" is the legend on the monument, and the fidelity and bravery of the Swiss guards, mercenaries though they were, formed the subject of enthusastic discourses on Sunday. There was a procession through the streets of Lucerne, and a large number of spectators, including many tourists, afterward assembled at the monument.

The monument at Congressional Cemetery, erected by the employes of the Washington navy yard in memory of Samuel Miller, was dedicated recently. Mr. Miller was a native of Pennsylvanian, and had been a master workman in the navy yard since 1860. He was one of the most popular men in the navy yard and his death was deeply deplored. The monument is a handsome one and bears this inscription: "Erected to the memory of Samuel Miller by employe of the Washington navy yard. June 1, 1829—April 13, 1892."

The model of the colossal statue of Moses to be erected in Albany, N. Y., is nearly completed. The statue will be ten feet high and will stand on a rocky pinnacle near a cascade. The model shows Moses with outstretched arms, summoning the wanderers in the wilderness to drink of the water which flowed from the Rock of Horeb after he had struck it with his rod.

B—*Stone.*

CORINTHIAN CAP, FROM THE PETERSBURG GRANITE COMPANY, PETERSBURG, VA. (SEE PAGE 501.)

STONE

VOLUME V. OCTOBER, 1892. NUMBER V.

ETCHINGS.

THE use of iron and steel in the construction of buildings in large cities continues to increase, and yet it has already reached a limit beyond which it may not pass. It will always have a place in buildings of utility where cheapness and rapidity of construction are the first essentials. For the enormously high buildings that have become a recent feature in construction in Chicago and other large cities, the employment of an iron or steel framework, covered with a thin veneer of stone or terra cotta, the bridge-like method of construction, is perhaps essential. But the architectural feature of such buildings is inferior, stiff and expressionless—quite the reverse of those forms, as Romanesque and Norman, that impress a sense of power from their massive and rugged simplicity, in which a massive and enduring material is essential, both for execution and for the creation of effects, that can only be realized with stone. The life of these iron trussed structures is yet a matter for conjecture, but from the nature of the materials cannot greatly exceed a quarter of a century, to say nothing of an improving taste that condemns them for their plain, unvarnished ugliness. The outer shell, that gives to the structure its only semblance of a building is only a veneer six to eight inches thick, and cannot survive much wear,

even should the life of the metal framework considerably surpass iron or steel bridges, that now are giving way to the more enduring stone arch. The impossibility of imparting to such veneers any expressiveness in decoration, or artistic sense by combinations that inspire strength is painfully evident to the most casual observer, in the tier upon tier of windows, and the monotony of a series of flimsy lintels piled up in fifteen to twenty layers.

The evolution toward a higher and more enduring type of street building is proceeding along with the anti-type, and the comparison is all the more apparent and painful when one sees the bridge-like structure in close contiguity with such a construction as the Auditorium, where power in design and grandeur of materials are combined with the utility that is the only excuse for the existence of the former. The evolution finds its type in every historic city, and the only difference between the development of ancient Rome from its wooden and mud structures of the age of the Scipios, to the brick city of Julius and then to the marble city of the Antonines, is in the method, and not in the materials. Nor can it be urged that modern utility of ground space compels to greater heights, for we see the two-storied palace of Pansa in Pompeii expand into the Colosseum of Vespasian and Titus above 160 feet in height, and the municipal effort to reduce the height of structures in Chicago to a maximum of ninety feet, has its exact counterpart in a decree of Augustus limiting the height of the palaces of the aspiring nobility to eighty feet.

The struggle between pure utility and the human aspiration for self-perpetuation by enduring and artistic forms always has and always will be limited only to its possibilities, and is in direct measure with its industrial development and wealth. That wood, brick and iron follow in the American development of its city architecture, is an essential natural to the colonization and development of a virgin continent, and the handiness of manipulation of its building materials. But the very prodigality of building stones of every hue and quality known to lithic geology, invites to its most luxuriant employment in both architectural and monumental art, that is now in pace with, and is as certain to surpass all other material, as it is infinitely more capable of variety, whether viewed from its mobility of art expression under the hammer or through its intrinsic expression of power, endurance and security. Its adaptability for combination is not possessed by any other material, and whether it be employed in the fanciful tracery of a Venetian facade, or the elegant refinement of a Grecian column and entablature, or the massive strength of Roman arch and Norman tower, it fits in place with splendor, or restfulness, or power with equal grace. Even the shadows of the rough granite columns of the prophetic circle of the Driudical Cromlech, speak with mysterious power of a past when Cæsar's legions were hovering about the forests of Quiberon, and whispering legends

of forgotten races, even as the fragments of the Parthenon teach us the lesson of a civilization yet to be, that

> "Work of nobler spirits flown.
> Bright as of old, the sunbeams o'er thee sleep
> In all their beauty still—and thine is gone!
> Empires have sunk since thou wast first revered,
> And varying rites have sanctified thy shrine.
> Mourn, graceful ruin, on thy sacred hill,
> Thy gods, thy rites, a kindred fate have shared;
> Yet thou art honored in each fragment still
> That wasting years and barbarous hands have spared;
> Each hallowed stone, from rapine's fury borne
> Shall wake bright dreams of thee in ages yet unborn."

Shapeless mounds of moldered brick alone define the site of Babylon and Nineveh, that live only in the records of that strange people that were taught in that strange and stony Nile region a mental immortality, that was physically wrought in stone in the pyramids, and indestructible granite temples of Karnac and Thebes. The written records of the ancient world concentrated in the Alexandria library went the way of the old civilization that was rescued from utter forgetfulness by the Rosetta stone.

American cities of a night, in spite of their gourd-like growth, still will not wither in fire and rust, nor molder in shapeless mounds of brick, for along with the wood and the iron and the clay are many buildings and monuments in the same imperishable stone that binds the present with the past, much as the stone bridges of the Tiber, built twenty centuries ago, still carry their loads, and do their work to the toiler of to-day as they did it then, as if to tell modern humanity not to build for its day and generation alone.

H. C. Williams.

AT THE HEAD OF THE LIST.

"I take twenty-seven daily and weekly papers and magazines, and after looking through the four numbers of STONE so far received, I would drop any other one from my list before I would drop STONE."—*Frank A. Kimball, National City, Cal.*

STONE PRODUCTION—.II*

ALABAMA.

THE kinds of stone produced in this state are, in the order of their commercial importance, limestone and sandstone.

LIMESTONE.—This stone comes from twenty-one quarries, distributed over the following counties: Shelby, $87,540; Colbert, $69,494; Lee, $52,500; Blount, $42,000 Franklin, $28,586; De Kalb, $16,333; Etowah, $13,567; Jefferson, $10,000, and smaller amounts in Jackson and Talladega counties. The value of the entire product as sold, including the value of the lime made from it, was $324,814. Of this amount the value of lime produced was $178,248. Other uses to which the stone is put are, in order of importance, blast-furnace flux, building, and street work.

ANALYSIS OF LIMESTONE FROM CHEWACLA, LEE COUNTY.

	Per cent.
Calcium carbonate	57.73
Magnesium carbonate	41.58
Ferric oxide and alumina	.12
Siliceous matter	.89
Total	100.32

SANDSTONE.—The amount produced in 1889 was valued at $43,965. The stone comes mainly from Jefferson county, with a product of $28,500, and small amounts from Colbert and St. Clair counties. It is used principally in the erection of buildings, a small quantity being devoted to bridge, dam, and railroad work.

NEW AND PROSPECTIVE DEVELOPMENTS.—Marble has been found near Florence, Lauderdale county, one mile from the Louisville and Nashville railroad, and it is possible that developments may be made at this point. The Shelby Lime and Cement Company opened a new limestone quarry in February, 1890. The Cherokee Stone and Railroad Company opened a sandstone quarry in Colbert county in the fall of the same year.

ARIZONIA.

Sandstone and limestone in small quantity are produced, the former in Maricopa and Yavapai counties and the latter in Gila county. The product is used locally.

NEW AND PROSPECTIVE DEVELOPMENTS.—Messrs. Murphy and Austin, of Prescott, operated to a limited extent quarries of brown and lilac sandstone

*Report of United States Geological Survey for 1889-90.

in 1890. The completion of prospective railroad facilities will increase their operations.

ARKANSAS.

The kinds of stone produced in this state are, sandstone, $25,074; limestone, $18,360; granite and slate in small amounts.

SANDSTONE.—The counties producing sandstone are, in the order of their importance, Johnson, Sebastian, Conway and Miller. The product is used mainly for building purposes, although some is devoted to street and railroad work.

LIMESTONE.—Limestone comes from Independence, Benton, Washington, and Carroll counties, and is used chiefly for burning into lime.

GRANITE.—The production of this stone is limited to Pulaski and Saline counties, and has extended over only a few years; but the outlook for larger operations in the future is good. The granites of Arkansas, which are, exactly speaking, syenites, are known as the Fourche Mountain or Little Rock, the Saline county and the Magnet Cove syenites. The first of these

RESULTS OF TESTS OF ARKANSAS SYENITES.

Number.	*Description of Specimens.*	*County where found.*	*Area of surface.*	*Actual crushing load.*	*Pressure per square inch.*	*Reduced to correspond to pressure per square inch in two-inch cubes.*	*Ratio of absorption—1 to—*	*Specific gravity at 60° F.*
			Sq. in.	*Lbs.*	*Lbs.*	*Lbs.*		
1	Light colored elæolite syenite, slightly decomposed..........	Saline...	2.34	48,000	20,500	22,350	761	2.62
2	"Gray granite," a very light-colored elæolite syenite..........	Pulaski..	2.25	33,750	14,000	16,000	83	2.45
3	Brownish elæolite porphyry, occurs in narrow dikes..........	...do...	1.42	30,000	21,000	24,980	161	2.52
4	"Light-blue granite" (syenite)...	...do...	1.64	47,000	28,700	33,280	......	......
5	"Light-blue granite" (syenite,) somewhat darker.............	...do...	1.07	22,800	21,500	26,820	......	......
6	"Light-blue granite" (syenite,) still darker...................	...do...	1.57	35,950	22,900	26,745	1,673	2.64
7	"Medium blue granite" syenite	...do...	1.50	43,500	29,000	34,150	......	......
8	"Dark-blue granite" (syenite porphyry)......................	...do...	1.57	43,800	27,900	32,630	4,530	2.69
	Mean of last five specimens. Average for "blue granite"....	...do...	......	......	26,000	30,740	......	......

groups forms the Fourche mountain, a few miles south of Little Rock, and contains the so-called blue granite, which is an elæolitic augite hornblende syenite, and some gray granite, which is a light-gray cross-grained elæolite syenite. The blue granite has already become a very important building stone, and it is also used in the manufacture of paving blocks. The gray

granite has been produced to a small extent. The Saline county region contains almost exclusively elæolite syenite of a reddish or grayish color, which has found little or no market on account of its distance from the railroad. The rock of the third region is worked to some small extent in building railroad culverts and foundations of houses. The tests were made in the mechanical laboratory at the Rensselær Polytechnic Institute at Troy, New York, on a 50,000-pound Tinois Olsen testing machine. The specimens were cubical in form and were cushioned with pieces of bookbinders' board about three-sixteenths of an inch in thickness. They broke suddenly with an explosive force and in some cases the small fragments tore the heavy binders' board completely to pieces. In regard to the stone from Fourche mountain, it may be said that it is easily quarried, occurring in long ridges 200 to 300 feet in height, and by opening a quarry on the side of any one of these easy access to the stone is obtained, and perfect drainage and a convenient dump may be had at a minimum of cost.

SLATE.—A small quantity was quarried in Pulaski county in 1889. There is good reason to anticipate an increased production in the future.

NEW AND PROSPECTIVE DEVELOPMENTS.—Variegated marble is found in Marion county, and Mr. L. Matlock, of Yelville, opened a quarry of it in the summer of 1890. A large area of marble outcroppings has been traced out and mapped in the region north of the Boston mountains in this state. These marbles are susceptible of a high polish and are of several shades of red, pink, and variegated. They are said to compare favorably with the Tennessee marble, but investigations and developments have not yet proceeded to a point which justifies more definite statements as to the future. The American Onyx Company, of Kansas City, Missouri, opened a marble quarry in Benton county in the summer of 1890.

In northern Arkansas, according to the geological survey at present being conducted under the direction of Mr. John C. Branner, state geologist, there are six distinct beds of limestone. Each of these six beds will furnish marble, although the greater part of it has little commercial value. The third bed in the series furnishes an excellent building stone at almost every outcrop, and it is found throughout nearly all the northern counties. It corresponds quite closely with the Indiana oölitic limestone, being in the same geological horizon and resembling it in structure, except that it is more crystalline and takes a finer polish than the Bedford, Indiana, stone. It is more crystalline, less oölitic, and more fossiliferous in the western than in eastern part of the bed. It has been quarried at Batesville, Independence county, for building stone and burning into lime. The fourth bed in the series, belonging to the Trenton period, occupies the same geological position as the Tennessee marble, which it resembles in structure and appearance. It has been traced and carefully mapped through Independ-

ence, Izard, Stone, Searcy, Marion, and parts of Newton and Boone counties. It is known to exist also in Madison and Carroll counties, and possibly extends as far west as the state or beyond. Small quantities only have been quarried for local use in monuments and mantels. It varies in color through light gray, pink, red, variegated, and mottled. The fifth bed is found in great quantities in Independence, Izard, Stone, and Searcy counties. It is a fair building material and burns to produce good lime. Some lithographic stone has been obtained from it.

CALIFORNIA.

Until within a comparatively few years the demand for stone in this state has not been very great, and consequently the development and growth of the California industry is by no means in proportion to the resources in stone of all kinds which the state has revealed and which have been recognized and known for a long time. Most of the buildings of the state have been of pine or redwood, the abundance, accessibility, and cheapness of which have caused their general adoption. The mild climate has also tended to retard the adoption of the more substantial stone in the erection of dwellings. Insufficient facilities for transportation have naturally also been an obstacle in the way of quarry development, and in some localities where fine stone is abundant and accessible this drawback will be felt for years to come.

Even where the demand for stone becomes as great in comparison with other building materials as could possibly be expected, the number of large cities in California and neighboring states is sufficient to offer inducements for the development of more than a small fraction of the valuable quarry property known to exist, and shipments to remote points will have to be made before production will be commensurate with the possibilities. Such shipments are, however, by no means out of the question in view of the fact that a larger amount of eastern stone is shipped to California than would ordinarily be suspected. This is notably the case with slate, and to some extent also with other kinds of stone produced at eastern quarrying centers. This state produces the following kinds of stone, named in the order of their commercial importance: Granite, limestone, marble and slate.

GRANITE.—This comes from seventy-six quarries in the following counties, named according to the value of output: Placer, Sacramento, Sonoma, Alameda, Fresno, San Bernardino, Solano, Humboldt, San Diego, Tulare, Nevada, Los Angeles, Marin, and Calaveras. It is thus evident that granite is quarried at points scattered over an area extending from the extreme northern to the extreme southern part of the state. The great bulk of the product comes, however, from the first five counties, four of which are near Sacramento and San Francisco. The total output for the state in 1889 was valued at $1,329,018. Of this amount Placer county produced $299,000

worth; Sacramento, $289,000; Sonoma, $215,000; Alameda, $142,000, and Fresno, $120,000. Somewhat less than half of the output is used for street paving and a slightly smaller quantity for ordinary building purposes. The granite quarries in the southern part of the state, while capable of producing large quantities of good stone, depend for their demand upon the southern portion of the state, and consequently the production will be necessarily limited until a wider territory of consumption is made available by a decided cheapening in transportation. In Fresno county are recently opened granite quarries twenty-one miles north of Berendo. Large developments are promised, the stone being so situated as to be accessible and easily handled. It is not regarded as a monumental stone, but it does not stain and answers very well for building. Large quantities of fine granite are to be found at Declezville, Victor and Riverside in San Bernardino county; and at Temecula in San Diego county. In Placer county, Rocklin and Lincoln are the most important producing centers. The stone from these quarries takes a brilliant and lasting polish and is quite popular with builders. Quarries have been operated for about twenty years at Rocklin, Lincoln, Loomis, and Penryn. The Central Pacific railroad takes about 90 per cent. of the product to San Francisco. At Penryn the latest improvements for finishing and polishing granite are to be found in more complete condition than in any other locality in the state.

The Folsom quarries of Sacramento county are at a point one mile above the town of Folsom City, which is twenty miles from Sacramento. Stone from these quarries has been used in the construction of the stone viaduct at Mare Island navy-yard, and also at the state capitol in Sacramento. It also enters largely into the stone buildings in San Francisco. These quarries lie for two miles on both sides of the American river. In this vicinity one of the prisons of the state is located. A large dam constructed of granite across the American river was completed in December, 1890. The labor was for the most part convict labor furnished by the state. This great work was commenced in 1866, but for a complication of reasons was somewhat delayed until 1888, when it was reundertaken and pushed with vigor. Most of the granite recently quarried has been used in the construction of this dam and also of the canal. The enormous water power which this dam will render available will be used in the prison and also in the city of Sacramento, where it is expected an important industrial era will be inaugurated by the utilization of power from this source. The dam and canal are the most substantial structures of the kind on the Pacific coast. It is the intention of the granite company operating at this point to put large quantities of stone upon the market as soon as the canal and dam operations are entirely completed.

The granite-quarrying operations of Sonoma county are practically limited

to the production of basalt paving blocks, which has for years constituted an important industry in this county.

NEW AND PROSPECTIVE DEVELOPMENTS.—During 1890 new granite quarries were opened by Mr. Matthew Lumber, of Rocklin. The Western Granite and Marble Company, of San Jose, the Carlow Bros., of Sacramento, and the California Improvement Company of Oakland, are all engaged in new developments of quarry property.

SANDSTONE.—In 1889 sandstone was produced to the value of $175,598 from fifteen quarries scattered over the following counties, named in order of output: Santa Clara, Amador, Ventura, San Bernardino, Yolo, Solano, and Napa. Of the total output Santa Clara yielded $100,000 worth; Amador county was second, with a product valued at $35,000. At San Jose a sandstone of light color and good quality is quite extensively quarried. It has been adopted upon the basis of its merits and its accessibility for use in the construction of the Stanford University. The Sespe Mountain sandstone of Ventura county is claimed to be the finest sandstone in the state, particularly for ornamental building.

MARBLE.—Four quarries in San Bernardino, Amador, Inyo, and San Louis Obispo counties produced in 1889, $87,030 worth of marble. Of the total output San Bernardino produced to the value of $78,000, by far the larger part of the entire product. It is thus evident that southern California yields the bulk of the marble output of the state. The marble industry of California is in its infancy. The most advanced development is found in the quarries at Colton, San Bernardino county. Equipment for sawing' dressing, and polishing has just been completed. The stone is not what could be called strictly first-class, but occasionally fine blocks are quarried. The quarries are so situated as to render operations easy and inexpensive. The developments in Inyo county are watched with interest. Shipments are steadily being made, and it is expected that railroad communication with Mojave will be made before long. Considerable prejudice among California marble workers against the marble of the state has had to be overcome, and, in view of the fact that the best quality of stone is not usually obtained near the surface, such unfavorable impressions are natural, but not always fair. Time must elapse before the stone can be fairly judged.

NEW AND PROSPECTIVE DEVELOPMENTS.—The stockholders of the Carrara Marble Company in Amador county have been prospecting for a new railroad to their quarry. The marble from this quarry is regarded by certain experts in the state as the best to be found on the Pacific coast.

SLATE.—Eighteen thousand dollars' worth of slate was produced from three quarries in El Dorado county in 1889. The product was used for quite a variety of purposes and appears to give entire satisfaction to the consumers. The demand for slate has been such in the past as to cause its

importation from the East; the industry which has been opened up in the state ought therefore to thrive, and from present appearances it will grow steadily. At the Chili Bar slate quarry abundant water power is available, and while at present a large amount of dead work in stripping, etc., is to be done, the outlook for liberal production in the course of a year is exceedingly good.

LIMESTONE.—Twenty-two quarries, scattered over eight counties in the state, produced limestone valued at a total of $516,780. Of this amount $513,130 represents the value of lime manufactured, so that it appears that only a small quantity of the total limestone production of the state goes for anything else than lime. The productive counties, named in order of value of output, are as follows: Santa Cruz, $266,650; San Bernardino, $74,000; Kern, $47,630; San Benito, $37,500; and smaller amounts in El Dorado, Santa Clara, San Diego, and Placer. The first-named county has for years been the principal producer of lime. Wood is abundant, cheap, and to be had immediately at the quarries. Transportation to San Francisco is by water. These advantages will probably enable Santa Clara county to maintain the lead for years to come. The most improved appliances are in use, and the lime is undoubtedly the best in the state. In San Benito county active operations have been inaugurated and the stone is of good quality. The following analysis of the limestone in this county has been made:

ANALYSIS OF LIMESTONE FROM SAN BENITO COUNTY, CALIFORNIA.

	Per cent.	*Per cent.*	*Per cent.*
Carbonate of calcium	96.00	99.2	99.0
Silica	2.10	.7	.5
Gypsum	Trace.	Trace.	Trace.
Total	98.10	99.9	99.5

The lime produced has to be hauled by twelve-horse teams to the railroad, thus adding to the cost; but it is said that this increase in the cost is largely offset by the ease of quarrying.

(TO BE CONTINUED.)

William C. Day.

A STRANGE ACCIDENT.

PHIN. C. GAGE, a native of Lebanon, N. H., born in 1823, died in 1861, was in one way, the most remarkable man who ever lived, so far as known. He was the only man who ever had a tamping bar shot through his brain and recovered.

The circumstances of the case were such that the attention of physicians and surgeons all over the world has been attracted, not only while the man was suffering from the effects of the wound, but after he recovered and was about the country. Surgeons refused to believe the assertions of the attending physicians, and required attested statements from prominent clergymen, lawyers and others, who actually saw the case before they would accept the statements made.

The case has gone on record as the most remarkable in the annals of physiology and surgery, while prominent physiologists are, to this day, wholly unable to say how the thing was done without causing death.

The accident which made Gage famous occurred at Cavendish, Vt., Sept. 13, 1848, while blasting was going on in a cut through which the Rutland division of the Central Vermont railroad now passes. Phineas Gage, aged 25 years, was foreman of a gang of men who were employed in blasting. Gage had never had a day's illness from childhood and was, as far as could be determined, perfectly healthy. At the time of the accident he was charging a drill hole for blasting and sat upon a shelf of rock just above, but a trifle to the right of the hole, as he faced it. The powder and fuse were in position and he was in the act of tamping it in. He turned his head for an instant to look at his men at work behind him. His iron struck fire on the edge of the hole, an explosion followed and the tamping bar,

three feet, seven inches long, one quarter of an inch in diameter and weighing 13¼ pounds, was projected upward obliquely in the line of its axis, passed completely through his head and high into the air, falling several rods behind him, and was afterward picked up by one of the men covered with blood and particles of brain. The man was thrown upon his back by the force of the blow and his extremities moved convulsively a few times, but he spoke in a few minutes. His men carried him to the road a short distance away and he rode home in an ox cart sitting up by being supported. When he arrived at his destination he got out of the cart himself with a little assistance, and an hour afterward walked up stairs with a little aid and laid down upon the bed where his wound was dressed. He was conscious but very weak from loss of blood.

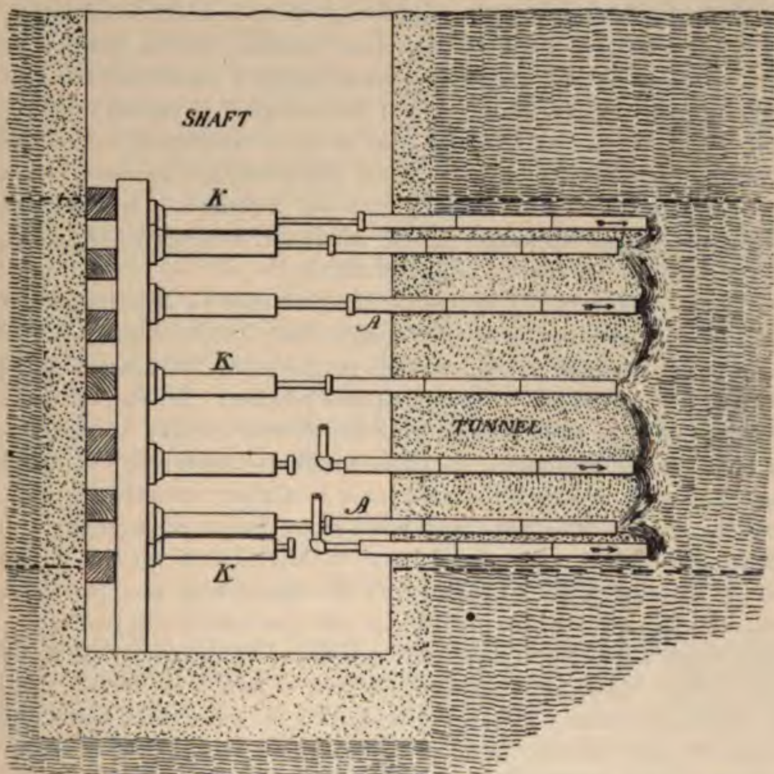
The examination of the wound showed that the iron, pointed at the upper end, entered the left side of the face by the pointed end, immediately anterior to the angle of the lower jaw, passed obliquely upward and obliquely backward, emerging in the median line, back of the frontal bone, near the coronal suture. The bones were broken in small fragments and forced upward and outward. The hole had much the shape of an inverted funnel, the edges of the scalp everted and the frontal bone badly fractured, leaving an irregular oblong opening in the skull two i ches one way and three and a half the other, through which the pulsations of the brain were distinctly seen and felt.

The wound was dressed and the man showed no apparent signs of serious injury excepting a curious agitation of the legs which were alternately retracted and extended. Then began a battle, the natural consequences of such an accident against the strong constitution of a healthy man. No one thought it possible that he could recover, but after a few days he began to improve and the fifty-sixth day from the accident the patient was up and walking about the house and piazza. The sixty-fourth day he caught cold and serious consequences were, for a time, feared, but he recovered Ten days afterward he was taken in a carriage and driven to Lebanon, N. H., a distance of thirty miles or more.

Gage passed the winter months in Lebanon, but returned to Cavendish the following April, carrying his iron with him. He was then in good health and flesh, but his mind was weak and childish, and the sight of the left eye was entirely lost. He visited South America, passing some time in Valparaiso, then went to San Francisco, where his mother had moved and died there with epilepsy, May 21, 1861, nearly thirteen years after the accident. The skull and are iron now in the museum of the medical department of Harvard University, and an illustration is given herewith, showing the track of the iron through the skull.

HARRIS' METHOD OF SOLIDIFYING QUICKSAND.

A NEW method of dealing with quicksand, so as to make it possible to form a firm floor on it and to sink a shaft through it has been invented by Mr. Robert L. Harris, of No. 1 Broadway, New York. It is a very ingenious process and has great promise. It has been applied in the construction of a sewer through the quicksand surrounding Providence, R. I., and great satisfaction has been expressed with the results.



SECTION SHOWING METHOD OF PRODUCING TUNNEL WALLS.

Mr. Harris' method depends on the great permeability of confined quicksand to water and other liquids. If two pipes are forced down vertically into a stream of quicksand, at a reasonable distance from each other, and

water is forced down one of them, it will find its way along the line of least resistance until it ultimately reaches the bottom of the other pipe. The current thus formed gradually carries the sand up the second pipe until eventually there is a chamber in the earth full of water instead of quicksand. The walls of this chamber, of course, are prevented from falling in on account of the hydrostatic pressure. Mr. Harris' idea is to force a cement down the first pipe after the chamber has been thus formed, and when it has filled the chamber to exert hydraulic pressure on the body of cement, and so force the cement in the chamber into the surrounding earth. In this way a hard cement is made to take the place of quicksand. If the quicksand consists of a material that could be used as a constituent of a hydraulic mortar then it would not be necessary to take it out by the water current, and the process would then consist in forcing in a cementing fluid which would combine with the sand and form a solid precipitate. The proper fluid to force in depends, therefore, entirely on the character of the material of the quicksand. If it is approximately a pure sand, the best fluid would be a pure cement grout; but if the material is muddy, a proportion of sand or plaster of paris would also have to be forced in. It will be seen that by variations and extensions of this principle, solid-wall shafts can be sunk through quicksands, floors may be formed for trenches through them, foundations for buildings can be made, and in other ways the bugbear of a quicksand can be successfully combated.

This method was put in practice for the first time in March last at Providence, R. I., for the purpose of obtaining a floor for the main out-fall sewer pipes that went through the quicksands surrounding the town. This quicksand, when dry, consisted of an impalpable powder. When saturated with water it is very hard and compact until disturbed. Under the pressure of a thin layer of superimposed earth it becomes apparently solid. When agitated, however, it runs like mush and is almost irresistible. All sorts of methods of excavation had been tried, but all were unsuccessful, and an excellent opportunity thus offered itself to Mr. Harris for the demonstration of the correctness of his theory. The experiment was carried out at the bottom of an excavation, just where the quicksand was reached. Four two-inch pipes were driven into the quicksand four feet apart to the distance of 17 feet below the excavated surface, or one foot below the grade of the proposed sewer. After a circulatio n of water had been obtained from pipe to pipe, thinner pipes were inserted in the two-inch pipes, and through them the cementing material was forced. After three weeks' time the excavations for the sewer reached this point, and it was found that the quicksand had been made solid for some distance round the lower ends of the pipes, and a solid floor had been thus made for the sewer excavation. The rock, which had been formed, showed the lines of flow of the cement,

and pieces of it taken out of the cutting presented a streaked appearance as shown.

The general method of forming a floor for an excavation in quicksand is shown in plan and vertical section. The method of producing a solid wall, where the pipes are gradually raised two or three feet at a time, forming quadrangular blocks of rock, at the same time is shown also. The cost of this process of dealing with quicksand is very small. The plant is not expensive and the materials used are cheap. The results obtained at Providence gave satisfaction to everybody, and completely met all expectations.

Mr. Otis F. Clapp, assistant city engineer of Providence, R. I. in charge of the sewer department, thus indorses the process: "At the second attempt of the first experiment in April, 1891, Mr. Harris obtained channels, as desired, at 25 feet below the surface of the ground, between pipes driven at four, ten and 14 foot distances. At a trial of the method, as a whole, made under adverse circumstances in the middle of March, 1892, in quicksand and fine sand, there was found upon excavation for construction in April that he had cemented the natural material at ten feet below the surface into fair artificial stone three to six inches thick with horizontal strata, and at a depth of 17 feet, the original bottom of four pipes, there was a thin, hard continuous floor of cemented material embracing practically the area between the pipes driven; the above was done without further disturbance of the surface of the ground than that required by the introduction of four two-inch pipes placed four feet apart in diamond shape. He has demonstrated to my satisfaction that by his method, strong floors, inclosures, monoliths, etc., can be readily formed in and of the fine earthy materials, where and as he wishes underground and below water level, without serious disturbance of the surface."—*Engineering and Mining Journal.*

LIFE OF IRON OR MASONRY.

THE life of iron railway bridges, according to English and German expert authorities, does not exceed seventy-five years. In many instances a shorter period of use renders them unsafe. This conclusion is the result of special investigation, instituted by European governments, to determine the durability of railway bridges. Nothing in ancient or modern construction has ever been discovered that in point of durability, is superior to good, solid masonry for bridges. The advantages of cheapness, rapidity of erection, etc., will, however, probably continue for a long period the use of iron for bridge construction.

NOTES ON QUARRYING.

DOES DYNAMITE BREAK DOWN?

IT is astonishing how general the belief is that dynamite breaks down. I have heard men who have been nearly all their lives in the powder business make the statement with all sincerity and belief that the direction of impact of a dynamite explosion is downward, and that in this respect dynamite differs from gun-powder or other explosives. An agitation of this question was recently brought about by the Norcross bomb-throwing in Mr. Russell Sage's office in New York. The exact nature of the explosive which Norcross used is a mystery. It is certain that, although the explosive was of sufficient force to kill two men, blowing one of them out of the window, and to annihilate the interior of the office, yet no hole was made in the floor. The following are some of the expert opinions in this case.

Mr. George H. Benjamin is reported in the *World* as saying:

"It is not a giant powder, nor a black powder, nor gun cotton nor nitro-glycerine. Each one of these explosives would have acted downward instead of upward and sideways. Had it been dynamite, a great hole would have been blown in the floor and poor young Norton would not have been blown out the window. This man probably had a small tin or brass cylinder—or perhaps it was of glass—filled with fulminate of mercury. This is the material used in firing blasts, and is the base of all caps and cartridges."

A correspondent in the *Engineering News*, referring to Mr. Benjamin's explanation, argues as follows:

"There seems to be a general belief that the explosive force of nitro-glycerine or dynamite is always downward, My experience has been that it is exerted in exactly the opposite direction from that in which the primal force is applied; for instance, a cartridge charged with cap on top of explosive and with fuse pointing north, the greatest force of explosion will be in a direct line south. I believe that while the tendency of all glycerine explosions, in the immediate vicinity of the explosive, is to rend, tear, or, in other words, totally annihilate any and all substances, yet the true explosive force which we wish to confine, direct or use will be found to follow a straight course, almost as if the same were confined within the diameter of a large tnbe until its force is expended."

The *Engineering News* says editorially:

"We do not agree either with the theory advanced by our correspondent, or with that credited to Mr. Benjamin by *The World*. The ordinary law of the expansion of gases applies to all explosions and the difference in effect between the combustion of black

powder and the so-called high explosives is due to the element of time in expansion rather than to differing components. When gas is generated it expands equally in all directions, and acts with equal force upon all surrounding objects. In reference to the "downward blow" exerted by high explosives, we may use the familliar illustration of "water tamping" in a rock blast. With black powder the generation of the gas is relatively slow enough to allow it to impart motion to the water, as resisting less than the rock, and the water is blown out. With the high explosives the expansive force is generated so rapidly that there is no time to move the water before the power developed and confined by the water is sufficiently great to rend the rock. The fact that a hole was not blown in the floor of Mr. Sage's office may be ascribed to a certain elasticity in the floor, causing it to yield slightly under the blow."

The following view of the subject is discussed in the February number of the *Engineering Magazine:*

"It must be confessed, that under the assumption that all the force of such an explosion is due to the expansion of the gas suddenly generated by the decomposition of the explosive, this view is unassailable. There are, however, those who, like the writer of this paragraph, deem it possible that there is something yet to be learned about the force generated in explosions of nitro-glycerine and dynamite, and it may be found that electricity plays a part in it. Whether the latter, or any one of the four different views relative to this explosive action be correct, their simultaneous existence is significant of the fact that its exact nature may be further and profitably studied."

Now, the fact of the matter is, that a high explosive, like dynamite, if discharged from a balloon produces an effect equal in all directions. There is a proviso, however, which must not be lost sight of, and that is, that the explosive must be uniform, not part wet and part dry, or part one kind of explosive and part another, but absolutely uniform throughout its construction. It must also be exploded by a cap or detonator that is sufficient to create an explosive effect simultaneously throughout the mass. Take the illustration of a lot of gas mixed with air in the body of a balloon. If it is exploded it will discharge a volume of gas in all directions pushing the outside air out of the way; or in other words, tending to produce a vacuum in the space occupied by the balloon. The difference between a gas or powder explosive and that of a cartridge of dynamite is simply one of degree. The dynamite is more quickly converted into the gaseous state, hence its action is rapid. Put a cartridge of dynamite on the ground and set it off, and you will dig a hole in the ground. Black powder in larger quantity and with more explosive force will go off with greater shock perhaps to the neighborhood, yet there will be no disturbance of the ground. This is not because dynamite breaks down any more than black powder does, but because the dynamite was converted into a gas so suddenly that before it had a chance to expend its force in the air it produced an effect and used up a portion of its power in the ground. To further illustrate this point, let us imagine a mass of compressed rubber resting on the ground; let this be a ball, and let us assume that it is compressed equally in all directions. If the string, or whatever is used to compress it, is sud-

denly cut the ball will expand equally in all directions, but where it touches the ground it will meet with resistance which will result in a slight bounce, but it is not likely that the ground will be disturbed. An explosive acts in the same way, and when that explosive is dynamite its bouncing tendency is so great that it acts like a blow from a sledge and a hole in the ground is the result.

One of the mysteries of a dynamite or powder explosion is why it sometimes creates such disturbance and destruction in one direction and not in another. We often hear of windows being blown out and buildings destroyed several hundred or even a thousand feet from the point of explosion, while at some points very near it there is no disturbance. I have known trees to be blown down a thousand feet away in one direction, while fifty feet away in the other the long grass and small bush were not affected. The explanation of this is simple. An explosion is a force which is governed by physical laws, and which may be likened to the laws governing the movement of a billiard ball. We know that when a billiard ball strikes a cushion at a certain angle it will leave the cushion at the same angle, that is, the angle of incidence is equal to the angle of deflection. An explosive force is first deflected by the ground ,or whatever it may stand upon. This produces a concentration of force in an upward direction. In other words, the force which originally tends to act in all directions is now suddenly deflected. This ground may be soft in one place and hard in another, or it may be irregular in structure, or it may not be level. All of these things tend to deflect the force. Then, again, the condition of the atmosphere and the position of buildings, trees, etc., all tend to cause the force when once produced to bounce, as it were, in its tendency to expand itself fully in the line where it meets least opposition. The blast from the mouth of a cannon illustrates this point. The powder being confined meets with resistance in every direction but one, and the result is a concentration of force in the direction of the muzzle.

Wm. L. Saunders.

THE GRANITE CUTTERS' NATIONAL UNION.

THE Granite Cutters' National Union was organized on Clark's Island Knox county, Maine, in 1877, the purpose being the advancement of the interests of the trade generally. The first thing to which the attention of the organization was directed was the abolition of the truck system of trading at stores owned and operated by the companies for which the cutters worked. When that was done the union turned its attention to the shortening of the hours of labor. Nine hours is now the maximum day's work, and at Chicago and everywhere west of that city, except St. Cloud, an eight-hour day has been established.

The founder of the order was Thomas H. Murch, who was afterward chosen the Union's first national secretary, resigning his office upon his election to congress from Maine.

The organization has but one salaried officer, the secretary of the national union. The principle of direct legislation is carried out to the full. Any member who desires the enactment of any legislation places his ideas on paper and transmits them through the local union to the national secretary, who places them before the national union, through the various local unions, for their action. The executive business of the national union is placed in the hands of a national union committee of three, selected every two years by vote of the union at large. The work they do for the union is paid for at the union scale. They are selected from the members of the local union where the seat of government of the national union is located. The union headquarters is moved every two years, the selection of the new location being made by vote of the membership of the various locals. The headquarters is now at Concord, N. H., and Josiah B. Dyer is the national secretary. He is also editor and publisher of the *Granite Cutters' Journal*, the organ of the national union.

Wherever there is work in the granite industry, a charter is procured and the state organizer is summoned to organize a local union. This union has the care of all matters relating to the granite cutters, and their interests within the jurisdiction of the union.

One good provision of the national union is the burial benefit of $150, which is paid to the widow or is used to defray funeral expenses and pay any outstanding bills a deceased member may have contracted during his last sickness.

GET MANY ORDERS.

"We are well pleased with STONE, and we get many orders which we are sure come through our advertisement in it."—*R. Hanger's Slate Works, Hydeville, Vt.*

THE PURCHASE OF WHETSTONES.

THE use for which the stone is wanted must always be considered carefully, for then the general character of the stone desired is easily decided, and it only remains to find a suitable stone. A few tests to decide what sort of a stone is being offered by the dealer are often useful. The hardness may be tested by a pocket-knife. If the stone is soft, like the water-of-Ayr stone, the knife edge will cut it easily on its flat sides without injury to the knife; stone of medium hardness, like the Hindostan, will cut on the edges with some difficulty; a hard stone, like Ouachita, for example, can be scratched by the knife point; while a very hard stone, like the Arkansas, receives no scratch from the knife point. The fineness of the grit can best be judged by drawing the edge of the finger nail backwards over the stone; the sensation produced indicates well the coarseness of the grit, and a little practice with various stones soon gives one expertness in judging their fineness. The finger nail will tell whether the stone is coarse or contains coarse particles by showing scratches; a fine gritted stone will make no visible scratches. The sharpness of the grit also will be indicated by the amount of the nail worn away.

The general appearance in shape and color also afford valuable means of judging a stone. The sides should be perfect planes, and the angles right angles, though for special purposes the edges may be beveled. Good stones seldom have a poor finish, uneven sides and irregular angles; on the other hand some poor stones are well finished, so entire dependence cannot be placed on these criteria. The reason why the finish should be a good one, is that a poorly finished stone is very sure to wear unevenly, and as soon as a stone has worn to an uneven surface it ceases to do good work. Soft stones are more liable to an uneven wear than hard ones, but care must be exercised in using hard stones, for when worn unevenly, they give much worse results than soft ones.

The color also is a good indication of the character of a stone. In a good stone the color should be very even, whatever shade it is; an even color denotes a homogeneous stone. Slight yellowish, reddish or brownish iron stains in light colored stones are not objectionable, but strongly marked spots of considerable areas indicate a change, generally toward hardnesss, in the quality of the stone. Stones may also have hard spots which are white. It is difficult to detect these spots when they occur in white stones, especially in the Ouachita stone, since that is whitened artificially by rubbing with pumice. If the pumice is dusted off, however, and the stone wet, the spots appear. These white spots are due to a closer aggregation of the grains of silica. If these spots can be seen at all, they look denser and harder than the ground mass. They are of occasional but not frequent occurrence; so far as known they are chiefly found in the Ouachita stone, though sometimes in the Arkansas. Soft spots have an earthy, soft appear-

ance, and may be tested with the knife. They are more likely to occur in sandstone. Wetting the stone, which is given as a method for detecting the spots, is a good method of showing the character of any stone.

A new whetstone, fresh from the rub-wheel, has the sharpest "bite" it will ever have. Purchasers should remember this, and not be disappointed because their stones do not cut so well after the slight roughness given it by the sand in grinding has been worn away. Some stones are rubbed with pumice by the manufacturers to make them look whiter and more attractive, and sometimes also to hide defects. The pumice gives to the stone a feeling of much sharper grit than they really possess. Any stone hard enough to be used as a whetstone is too hard to have a natural powder on its surface, so when a powder is found it may safely be set down as artificial. It should be brushed off and the stone examined in its true state.

Having these points in mind, one can safely select a stone for any special use. A stone for general use, however, is the one most commonly in demand, and as there is no stone which will answer all purposes, the whetstone for general use must be a compromise. If the work to be done is usually coarse, a schist or sandstone of medium hardness and fineness is best used. As the Hindostan stone is fine-grained, a sandstone suiting these conditions is not now known in the United States as a whetstone; schists, however, are plentiful. For generally fine work a fine schist or sandstone or the Ouachita stone may be used. The schist and sandstone are good and cheap, with certain advantages favoring the sandstone. The Ouachita stone is more expensive and requires better care than the others, but will also do better work. It will cut steel fully as fast as either of the others, and will give a much finer edge when properly used. It may be used as a razor hone in addition to other uses. Pointed tools cannot be applied to any of these stones without injuring them for ordinary use, and coarse work will injure the fine stones. It is economy for those using the fine stone to use first a coarse sandstone unless the tool is already prepared for the final edge.

A dull tool with a notched edge should no more be placed on a good whetstone, than a carpenter's chisel should be used to drill rock; yet such a use of whetstones is a common one. The purpose for which a whetstone is bought should be kept in mind, and it must be remembered that if used for purposes widely differing from those for which it is best adapted, the stone will be spoiled for its ordinary work. For this reason it is economy to have stones of different grades wherever tools are in constant use, as in carpenter and machine shops. For reasons already given, it must be expected that a whetstone will lose a little of its abrading quality with use; if it loses much, however, the conclusions may be drawn that it is not being properly used, that proper care has not been taken of it, or that it is

a poor stone; only do not be too ready to condemn the stone. Many good stones are condemned and given a bad reputation, when the fault lies either in the original choice of the stone, or in the use made of it, or the care taken of it.

L. S. Griswold.

SIGNIFICANT FIGURES.

JAMES G. BATTERSON, of Hartford, who built Connecticut's great marble capitol building, and who now has the granite contract for the $6,000,000 national library building at Washington, gives some interesting facts and figures regarding the long strike in the New England quarries. He says that in his quarries at Westerly, R. I., the strike this season has cost the quarrymen about $150,000 in wages. Their only grievance was wage contracts were not dated from May 1. The quarry owners were compelled to refuse because they had to make their contracts with customers earlier than that date, and it was imperative that they should know in advance of their contracts just what they would have to pay for quarrying and cutting the stone.

"I made an interesting computation last week," said Mr. Batterson. "It was this: I found the number of granite cutters in the United States and the sums they lost by assessment, dues and lost time. I assumed that they should appoint a trustee and pay to him all their union fees, strike assessments and losses, he to deposit the money at the rate of 3 per cent.

"I found that in five years the Granite Cutters' Union would have money enough to buy out the principal granite quarries, with all their machinery, in New England, and pay the cash for them. The granite cutters in New England have lost in wages by this strike about $2,800,000. This sum would have purchased half a dozen of the principal plants in New England, with all the cash capital needed for the business, and the strikers would have had something to show for their money. A few cents a day contributed by each man would enable them in a few years to buy out the plant and make their own wages without a resort to strikes."

TRANS-ATLANTIC NOTES.

STRIKES and rumors of strikes are the order of the day upon this side of the Atlantic. The carpenters in London, the bricklayers in Bristol and the masons in Cardiff, have each in turn been employed in industrial warfare, and as I write news comes of a serious disturbance among the salt workers in Cheshire. A strike of the watermen employed by the great trading corporation known as the Salt Union, has been in progress for some weeks. The salt workers, who are in sympathy with the watermen, refused to load river vessels with salt and the Union sent 100 men in a special train from Liverpool to replace them. These men were met on arrival by an enormous crowd and a fierce conflict ensued. The strangers were lodged in the salt sheds, but these were attacked and partly demolished by the mob who threw volleys of stones and brick-bats. The newcomers became so frightened that they left the place and returned to Liverpool. An attack was then made on the offices of the Salt Union at Winsford and the police were obliged to call for military assistance before peace could be restored.

We have our full share of labor troubles, although European manufacturers sometimes profit by the difficulties which you experienced in this particular. A strike among the marble masons of Boston, Mass., some time ago, has developed a new trade in Belgium. Dealers in marble fittings for soda water fountains were at the time forced to send their orders to Europe. The Belgian manufacturers laid themselves out to accommodate trans-atlantic customers and they have now a firm grip on the trade. "We do not fear the tariff," said one of these manufacturers to me a few days ago. "We'll always get in somehow and we would manufacture in the States rather than give up the trade we have there now."

If a stringent tariff caused Belgian manufacturers to set up establishments in the States, it will only be a repetition of what has already taken place in Germany and France. No trader exists who is more persevering than the average Belgian. He is always ready to work a new market. But give up ground he has already won? Never! For many years he did the lion's share of the marble trade in Germany and France. Moved by the complaints of German and French manufacturers, the governments of both countries tried to shut him out with high tariff. He at once carried the war into the enemies' camp and promptly set up factories just over the frontier.

He is now more firmly established in these countries than ever and the first state of the native manufacturers was better than the last.

Millions of pounds sterling have been sunk in the making of the Manchester ship canal which is yet very far from completion. It is doubtful whether the promoters will ever see any interest upon their money. They are now complaining that the work has been extravagantly done and special stress is laid upon the fact, that the coping of the docks is of granite, whereas if millstone grit had been used, it would have answered the purpose equally well and about £60,000 would have been saved. This, however, seems to be but a drop in the bucket when the total expenditure is considered. Still the granite merchants do not seem to have done badly. One firm alone having supplied granite of the value of £120,000.

One of the difficulties under which the British monumental trade labors, is that which the London *Star* calls "the Parsons corporation." In this country the churchyards are claimed to be the parsons' freeholds and heavy fees are exacted in many places, not only for the burial of bodies, but also for the erection of monuments and even for inscriptions, which may be added to the price. So carefully are the rights of parsons safeguarded that it often happens when a churchyard is filled and a public cemetery is secured at the expense of the tax-payers, that fees have still to be paid to the parish clergyman. A dispute which has recently taken place between a burial board at Putney near London and the vicar of the parish, illustrates the troubles in a striking manner.

A report of the board states that the cemetery cost £15,000 and that the amount received in fees for three years ending March, 1892, was £1,240. Of this the vicar took £869 and two other clergymen between them £56. When the board had paid for the grave digging they had £213 left and a net annual income of £7. Here is a tariff in which the fees claimed by the clergymen and the board are placed side by side.

	Parson.	Board.
For a brick grave	£10.10.0	£0.11.10
A first-class private grave	3.15.0	0. 7. 4
A second-class private grave	1. 0.0	0. 4. 4
Reopening a brick grave	6.14 0	0. 2.10
" first-class grave	3.11.0	0. 3.10
" second-class grave	1. 5.6	0. 3.10
A head and foot stone	1.10.0	0. 5. 0
A monument	6. 6.0	0. 5. 0
Iron railing	5. 5.0	0. 5. 0

The present dispute has been settled by an agreement to give the parson £200 a year in lieu of the fees which he has hitherto received. But even in such case the board must obtain this amount from someone and it is probable that heavy fees will still be levied upon every monument or marker which is set up. When it costs £6.6.0 to obtain the permission of the vicar

of the parish to erect a monument, and another £5.5.0 to inclose the lot with iron railings, it can be imagined under what difficulties the British monumentalist carries on his trade.

Arthur Lee, Editor The Stonemason.

POINTERS FOR ARCHITECTS.

THAT there has been a marked improvement in architectural design in this country during the past few years must be evident to the most careless observer, and it is the more gratifying that this advance is not confined to any particular part of the country, but is seen everywhere one goes. To the trained architect, however, during his holiday wanderings especially, when he has more leisure to take note of his surroundings and reduce to order his impressions of them, there is continually present a regret that a careful study of the principles of design is not more general, in order that the grave errors in composition which one so often meets with, and which so seriously mar otherwise meritorious work, might be avoided.

The most serious and well nigh universal defect is an absence of refinement, both in mass and detail, and a lack of restraint and evident disregard of the value of temperance as an architectural virtue. Command of material, ingenuity in meeting difficulties, readiness in the solution of new problems, are everywhere evident; but there seems to be a lamentable lack of that artistic perception which distinguishes intuitively between the crude and the refined, and one especially laments the degradation of so many compositions through the indiscriminate use of ornament, and disorderly arrangement of the mass.

If every architect who is conscious of an indecision in his general methods of composition, or who feels in particular cases an uncertainty as to the best solution of the problems in hand, were to make a resolution that for a twelvemonth every new design should be rigorously balanced and restrained by an absolute symmetry, both in plan and elevation; and that expression should be made to depend on arrangement of the mass in gross rather than on any characteristics or disposition of the ornament; and if to this were added a determination to use "detail" less profusely, reserving it for the more important centers of interest in the composition, and using it there judiciously, and making it as delicate and refined as possible; an immediate and profound change for the better would result, and one that would be quite as much appreciated and understood by the general public as by the profession.

We make this suggestion, not because symmetry is an indispensable factor

in every successful composition, nor because ornament is not sometimes to be used profusely—for neither proposition would be true—but because the discipline which would result from working within these self-imposed limitations would give to the artist renewed interest and pleasure in his own work, and leave him at the end of the period with a sense of artistic power which would prove of the highest importance to him in his professional advancement. Members of the profession who have had the benefit of school training either at home or abroad do not need any such hints. They already know the value of the discipline and restraint imposed and cultivated by a course of academic training; but there is a large number of architects who are doing good work and capable of doing better, who lack the direction toward, though they feel the need of, a systematic method of composition, and it is to them we have ventured to make this appeal. There are of course some special cases in which symmetry cannot be had owing to peculiarities of site, but there are few problems to which it is not to be applied, and fewer still which will not be the better for it. A striving for simplicity in all cases where it is suitable, and temperance everywhere in the modeling of mass and detail (including the use of color) would avoid most of the errors which disfigure a great deal of our current work, and detract from the merits of much that is otherwise of the highest promise and merit.—*Architectural Era.*

NEW ENGLAND NEWS AND NOTES.

THE great strike of granite workers in this section of the country is practically over, Concord, N. H. being the only place of any importance where the difficulties are unsettled. The rock upon which the negotiations strike every time an attempt is made to settle, is too unreasonable on the part of the union to be worth noticing—the question of the disposition of the cases of the men who left the union and went to work and the number of apprentices, in effect arrogating the running of the employers' business to the union. In the other centers this question was settled satisfactorily simply because the members of the local unions saw things in the right light and accepted perfectly reasonable terms. They are now at work and cases of self-denial among their families will be less numerous than they have been since May.

Business in all the granite centers is brightening. Men are earning money and can spend it. Manufacturers can complete contracts and get the return and the commercial circulating medium, money, will go on its way doing good and bringing necessaries and comforts to the home of all granite workers and employes in allied trades.

At Bradford, Vt. and adjoining New Hampshire towns, a stock company has been organized with a capital of $100,000 to develop the granite quarries in Black mountain, now owned by G. W. Chapman & Co. The stock is being rapidly raised and shops will at once be erected and a large business done. It is probable that the Concord and Montreal railroad will build a spur track from Pike Station to facilitate handling the stone. There are three colors; pure white, as good as exists anywhere, the dark, taking a very fine polish, and the mottled, some of which finishes up in a superior manner.

The Merrimack Valley Granite Co. of Concord, N. H. has completed its permanent organization, choosing these gentlemen as officers: President, D. W. Sullivan; vice-president, Cornelius Bresnahan; treasurer, Arthur E. Dole; clerk, W. B. Sawyer; superintendent, James Rooney. The directors are D. W. Sullivan, Cornelius Bresnahan, William J. Ahern, Eugene O. Callahan, Lawrence Moynihan. It is a coöperative company and has a capital of $5,000, all subscribed for and paid in. Sheds 75 feet long are being erected at the north end of the city, near the Northern railroad, and when done will be fitted with all the modern improvements for economical

granite handling. The start will be made with fifteen men and the number will be increased as occasion demands.

A new break water and wharf is being built at Lake Shore Park in the town of Laconia, N. H. The stone foundation, built of granite, will extend into the lake about 150 feet. The stone work of the upper portion of the structure will extend 100 feet from land and will be 21 feet wide. Two cribs, 15x30 feet, will extend at right angles, making a perfect harbor for steamers on either side. Contractor Weeks has the work in charge.

Dow & Randlett of Concord, N. H., have prepared the plans for the new Colby Academy building at New London. Work rebuilding on the old site will begin immediately, and the structure will be of brick with granite for window and door sills and trimmings, and the roof will be slated. The building will be 106 feet long, 64 feet wide and two stories high. The contract calls for its completion, ready for use, January 1, 1894.

Mica quarrying is a growing industry in the New England states, some towns being particularly rich in the mineral. Grafton county, in New Hampshire is particularly rich in it and the quarries are paying heavily. At Warren the Mica Crystal Company is turning out a valuable paving material known as Mica Crystal, which is attracting considerable attention among street and road engineers. The road is perfectly noiseless and hard, yet sufficiently springy to make it easy to travel over. So far the experiments in street construction have been successful.

Barclay Bros. and McDonald & Son of Quincy, Mass. have bought the Dirigo Granite Company's dark granite quarry at Barre.

THE LARGEST DAM IN AMERICA.

THE largest power dam ever built in this country is that now approaching completion across the Colorado river at Austin, Texas. This dam will be, when completed, 1,150 feet long, 60 feet high, and 18 feet wide at the top. The up-stream face is of limestone, and is vertical; while the down-stream face is of Texas granite; and the interior of rubble masonry of small stone and cement. There will be about 9,000 cubic yards of granite, 6,800 cubic yards of limestone, and 35,000 cubic yards of rubble in the dam. The dam is intended to utilize the power of the Colorado river for electric lighting, electric railway, pumping the city's water, for factories, etc.

JOSEPH H. PETER.

JOSEPH H. PETER began business in Louisville, Kentucky, when he was but 19 years old, and has been there 17 years. His beginning was in the the firm of Peter & Facket, doing business two years. This firm was succeeded by the firm of Peter, Holloran & Zink, with mill and quarry at Salem, Indiana, and offices and works at Louisville, Kentucky. For five years the company under that name did a large business, but was succeeded by the firm of Peter & Burghard. In 1888, the Peter & Burghard Stone Company was organized, and Mr. Peter elected president, which position he still holds. The offices and mills of the company are at Fourteenth and Maple-sts., Louisville, Kentucky, and a large wholesale business in stone and marble is done. Mr. Peter has always been active in association work, and has held numerous offices in the Ohio Valley

Association, his influence contributing materially to the building up of that association. He has successfully solved the labor question affecting his section, and is known among his own acquaintances as an active, brainy man in the conduct of his own business.

THE PORTLAND CEMENT OUTPUT.

THE Portland cement industry is probably the most important of its kind. It has developed on its merits, and its reputation seems to be impervious, both to weather and time. Faith and rock are equally adhesive to the powdered compound, that when put into service defies the tooth of both rats and years. As might be expected, its manufacture is extensive, and where nature has grouped its constituent materials, enterprise has not been lacking in their appropriation. It is now produced in graded kinds, not only in Great Britain, but in France, Germany, Italy, Russia, Denmark, Norway, Sweden and the United States, the annual out-

put of this cement in Europe amounting to not less than 20,000,000 barrels. The English product is about 8,300,000 barrels per year. In 1850 there were but four factories in operation, and the process of manufacture somewhat crude in comparison with more modern methods. The quality of the product has not suffered, either in reputation or service, from any changes in the British process of manufacture. This cement was imported as early as 1868 into the United States. Its reputation established, the imports of 1882 scored at 370,400 barrels, and in 1891 maximized into 3,000,000 barrels. The manufacture in this country is not, as yet, of a heavy character, owing to the severity necessary in handling material. The process includes the pulverizing of rock into fine powder, molding it into bricks, burning it in alternate layers of coke and grinding the clinkers, a series of operations involving considerable care, heavy expense and about eight days to produce the commercial article. Improvements in these methods have been developed, in which the process is shortened and the product improved.

The largest Portland factory in the world is claimed by France, where the output is 800,000 barrels per year, the total of France manufacture for the same period being placed at 1,800,000 barrels, a remarkable increase in comparison with the output of 1880, when the invoice was but little more than 700 barrels. The Belgian product tallies 800,000 barrels per annum. Russia, since 1857, has developed eight cement works, and a yearly output of 900,000 barrels. Germany has sixty large establishments, where, though the raw materials are of an unfavorable character, the scientific and industrious Teuton produces an excellent article, and manages an annual output that is a close second to the British product. The Scandinavian nations grouped together in the North Atlantic latitudes of Europe, operate ten factories with an annual product of about 800,000 barrels. The commercial value of the total European product is estimated as exceeding $36,000,000 as an annual average.

It is thus seen that the distribution of the Portland cement industry is wide, and its service in no sense diminishing, while as a commercial factor it is of growing importance.

AUNT MEHITABEL'S TRAMP.

MY aunt, Mehitabel Joggins, is a good soul. She would rather believe well of the humblest creature than to suppose that he could do ill. And for a woman who is getting a little past middle age she is a surprising radical. She has a theory that reforms can be worked more effectually by kindness than by force, and I am bound to say that, in her own excellent practice, she has met with success enough to surprise her friends who adhere to contrary doctrines. There, for instance, was her adventure on the 18th of August, that I am about to relate. We had finished breakfast an hour before, and were sitting in the parlor, sewing, with the blinds closed on account of the sun on the best carpet. The front gate creaked, and when I peeped through the blinds to see who had come, I exclaimed:

"Oh, aunt, are you sure the doors are locked?"

"Yes, Mabel Jerusha, I am quite sure they are locked. Why do you exhibit so much feeling on the subject?"

"Hush! There is the dreadfullest looking man examining the house. I know he wants to break in."

"How absurd, child! Why should he break in when he can come without breaking! Yes, as you say, he is somewhat unprepossessing. I do not think he has had his proper sleep."

"But why does he look around in that sneaking way?"

"Mabel Jerusha, it is uncharitable to speak of strangers in that manner. I presume the man is looking for the door—or dogs."

"He is coming up the steps."

"Ah, now that he has removed his hat you see his face has a different character. There is quite a marked development of brow."

"I presume he struck it against a house. And look at those coat tails!"

"The poor man is timid about pulling the bell. I must go to the door."

While Aunt Mehitabel was in the hall I moved furniture around the room, for I thought it as well that her visitor should know that there was more than one person in the house, but I could hear all that passed between them. My aunt began in her pleasant rising inflection, "Good morning."

There was a pause; then a hoarse voice answered, in a reflective tone, "This is onusual."

"Is there anything in particular that you would like?"

"Well, now, mum, I suppose that's your way of coddin' people."

"Codding?"

"Larkin', you know. Makin' b'lieve. F'r instance: You has a dorg. You intends to set that dorg to eatin' my legs, and you begins by askin' good mornin', and would I like somethin'."

"Why, we have no dog."

"No?"

"Indeed, the nearest we come to a dog is a cat."

"Quite right, mum. Dorgs is unreliable beasts. You never know where they're goin' to take holt. Did you ask if I was in want of somethin', mum? Well, yes, mum. Fact is, I've been travelin' quite a ways, mum, and it's too early to get a check cashed at the bank. If you think you could trust me for a breakfast, I b'lieve I'd like one."

"To be sure, you may have one and welcome. There is the door mat. You will find water and soap—I hope you are not ill."

"No, mum. Jest a passin' sensation, like."

"You will find water and soap at the further end of this passage. Also, a clothes brush. I suppose you have a tooth brush and a comb."

As the man shuffled into the back room aunt looked in and whispered, "A case for kindness." Then she went and piled wood into the stove. Pretty soon she came back with him and walked straight into the parlor.

"This," she said, "is my niece, Mabel Jerusha Waterman. Mable Jerusha, you will entertain this gentleman while I get his breakfast. Do you prefer eggs soft or hard, sir?"

"I most generally gets 'em hard, mum."

"Very well. I will ring when the table is ready."

I bustled around and pretended to dust the furniture, while out of the corners of my eyes I studied the tramp—for that is what he was, a regular tramp. He had washed himself, timidly, and his cheeks and nose and knuckles were passably clean, but I saw traces of mud in his whiskers. He crossed his legs, looked at the uppermost foot, encased in a broken boot, put it down, swung up the other leg, put both feet on the floor, folded his hands, let himself back gently, as if afraid the chair would break and finally said:

"Is them real?"

"What?"

"Them candlesticks."

"Yes, we use them every evening."

"I mean, what are they made of?"

"Brass."

Then he crossed his legs again. Presently he remarked,

"Excuse me fer bein' so hoarse. There was an awful draft at Dutton's Corners last night."

"Indeed?"

"And the beddin' was damp."

After awhile he resumed:

"That's a mighty good lady that lives here."

"My aunt? Yes."

"She don't even keep a dorg."

"True."

"Does she shoot?"

"How absurd!"

"No? She don't shoot? I didn't know but p'raps she amused herself that way, sometimes."

Another long pause. Then the tramp broke out again:

"Say, is your aunt a good runner?"

"I never saw her run."

At that moment, to my relief, the bell rang, and I ushered our visitor into the dining-room. Aunt had put her best china and a clean cloth and a bunch of flowers on the table, but what seemed to interest the tramp more was a beefsteak, flanked by fried potatoes, scrambled eggs, bread and butter and coffee. He looked from the table to aunt in a doubting way two or three times, and wiped his mouth on the back of his hand. When aunt drew up a chair and asked him to sit down, he was evidently much impressed. But after he got a taste of the steak he slashed into it at a dreadful rate. Then he finished the eggs. Then the potatoes. Then he began on the bread and butter.

"Would you like some more eggs?" my aunt inquired.

"Well, mum, if you could spare about six more I would try, quite hard, to eat 'em."

So half a dozen eggs were boiled and he smote his way through all of them.

"Any doughnuts?" he asked.

"We are out of them just now," said aunt.

"Then, could I have some caramels?"

"Caramels! For breakfast?"

"Yes'm."

"We haven't had any in the house for months. Are you fond of them?"

"Well, mum, I don't rightly know what caramels is. I heard people say once as they were somethin' to eat."

"Perhaps you would like another cup of coffee."

"Yes'm. Unless," he added eagerly, "there's beer."

Aunt's tone was really cold: "No. We do not use it. We do not believe in it."

"Not b'lieve in beer! Why, mum, jest you go down to Noo York and you'll stack up agin more beer—well! And it's bully good! Beg pardin, mum."

"I mean that I do not approve of it."

"Yes, I s'pose there's people as it disagrees with. Same as a friend o' mine. Used to make him bilioust."

"Do you make many friends in traveling?"

"Not many, mum. Them as I meets is seldom good friends, neither. It's more common of 'em to cut up rough than to do the genteel, like you've done. They tell you to do as you'd be done. Humph! I've done lots of people and never got thank you for it."

"Do you have employment?"

"More than I generally wants. Lor! What a lot of work I've done! In lots o' different places."

"You have been around a good deal."

"Yes'm. I've lived in Joliet an' Concord, an' Wethersfield an' Auburn, an' lots o' more towns. An' I worked in every one of 'em. Hard labor, I tell you. Work's only good in moderation. When I was taken—when I left home my father he says to me, says he, 'Ferdinand P. H. McGroarty, whatever you do, work.' And I've did it."

"Do you expect to remain here long?"

"There! I knew I was stayin' over my time."

"No, I meant in town."

"Oh! Excuse me. No, mum. I'm due in Noo York three weeks before 'lection, and the roads is good, now. Israel Casey—p'raps you've heard o' him? He's my cousin. He's a statesman, Casey is. Belongs to the aldermen, Casey does. He always gets work for me in November. Last time I was on he said he'd put me into politics."

"Good land! You may be an alderman yourself."

"Yes, mum. I have most of the qualifications for one. Is there any tobacco in the house?"

"No. We do not use it."

"Women seldom does. They makes a mistake."

"It is rather a low taste."

"Is it, mum?"

"I hope you will discontinue to smoke."

"I often discontinues whether I wants to or not, along of not bein' able to do it. I've discontinued since last Thursday."

"That was doing well."

"I didn't realize it. Mum, can I have some more eggs?"

"Why, of course. Pardon me for my oversight. Mabel Jerusha I wish you would get a little more wood.

We went to the kitchen together and I stopped there for a while to upbraid my aunt for excess of consideration for this Mr. McGroarty. But she only replied:

"It's plain that he has nobody to do for him. Perhaps he is unhappily married. He will be grateful for our attention. See if he is not."

In a few minutes we returned to the dining-room. A window was open, and the tramp was gone.

"He can't have left without finishing his breakfast," said aunt, a little anxiously.

"What's this?" I asked, pointing to a newspaper with some pencil writing on its margin. We bent over the writing together. It ran as follows:

MUM: I have took the libity to borrow your spoons. I hopes to return them next time I get a plase. You have ben verry kind and I have eat about 2 dollers for brekfust. Reglar gorge. So I leeve you 2 spoons in token of apresashun.

Your fekshunate frend, FERDINAND P. H. MCGROARTY.

"What do you think of your tramp, now?" I asked.

"It's dreadful."

"It's usual."

"Mabel Jerusha, I'm going upstairs to have a fit. If Miss Maddox calls about the sewing circle, tell her I am busy. If the grocer comes tell him we shall want more eggs."

"Oh, please don't do it, aunt, dear."

"I really must."

"But these spoons are the plated ones."

"Why, so they are. I declare, I had forgotten to fetch out the silver."

"And that miserable creature will try to sell them."

"That is so. It's too bad. He will think we have been imposing on him. We ought to write and tell him they are not solid."

"You will postpone the spasms, won't you, aunt Mehitabel?"

"Perhaps I'd better. How unfortunate it is. And only think, he said he had the qualifications of an alderman!"

C. S. Montgomery.

SANDSTONE INTERESTS OF NORTHERN OHIO.

PART I.

QUARRY OF MALONE STONE CO., (EUCLID.)

IN the production of sandstone, Ohio stands in first place among the sandstone-producing states of the Union, and second in the value of its total stone output. By far the most of the stone comes from Cuyahoga and Lorain counties in the northern part of the state. Here are located the interests of the Cleveland Stone Company, the Malone Stone Co., the Grafton Stone Co., the Ohio Stone Co., the Forest City Stone Co., the Maxwell Bluestone Co., and the Elyria Stone Co., together with a number of others of minor importance. The stone quarried by these concerns is known variously by geologists as Berea, Amherst or Ohio stone. While they vary largely even in limited districts in fineness, color and density, yet they exhibit quite uniform characteristics, the difference in color being due to the character of the iron oxide contained, and the texture or density varying with the size of the sand making up the deposit. Chemically they are closely identical and physically are composed of angular, sharp grains of sand bound together with the cementing material. The deposit is quite regular, and often perfectly horizontal and extends over nearly 1,000 square miles, ranging in thickness from 90 feet down to thin sheets.

In the Euclid district, the first visited by the writer, there is more carbonate and less sesquioxide of iron in the stone, producing a beautiful blue effect. This district is located but a few miles east of the city of Cleveland and is worked by the Malone Stone Co., the Forest City Stone Co., the Maxwell Bluestone Co., and Maxwell, Rolf & Co.

By far the largest possessions are those of the Malone Stone Company which have been worked for twenty years. This company has sixty acres, ten of which have been developed. They also own the right of way of the Euclid railroad company which connects the quarries with the trunk line

roads five miles distant. This railroad is leased by the Malone Stone Company to the "Nickel Plate" road. The stripping is about twenty feet, partly through rock for which a market is found at Cleveland in street improvements.

MALONE STONE COMPANY, EUCLID DISTRICT.

Over twenty feet of good rock is found beneath the stripping, and to quarry and saw it requires the services of 100 men, one channeler, three steam drills, six derricks and six gangs of saws. A market for it is found as far east as Boston, west to Nebraska and south to Charleston, S. C., which explains more satisfactorily the good qualities it possesses than any other statement that can be made.

Just over the hill to the east of the Malone Stone Company, are the possessions of the Forest City Stone Company, comprising forty acres, a portion of which have been worked for twenty-two years. Good stone is found here to a depth of sixteen feet and seventy-five employès are busily engaged in quarrying it, using a channeler, three drills and six derricks. This concern has also a steam sawing plant here with six gangs seven feet six inches in size, enabling them to saw a block fifteen feet in length and eight feet, six inches high.

QUARRY OF FOREST CITY STONE CO., EUCLID DISTRICT.

Adjoining the possessions of this company are those of Maxwell, Rolf & Co.,

and the Maxwell Bluestone Co., quarrying rock of approximately the same color and texture as the others.

In the same county (Cuyahoga) almost within the confines of the city of Cleveland is the quarry of W. H. Caine, which, because of its close proximity to a good market, enjoys exceptional advantages. The stone is of the same quality as that in the Euclid district and meets with a ready sale. Mr. Caine has also a steam stone saw mill at this place.

Twelve miles farther south on the Valley railroad is the town of Independence where are located the quarries of the Ohio Stone Company and Little & Pettibone, well equipped with modern machinery and possessing excellent shipping facilities.

The possessions of the first named concern are variously located and an illustrated description of them will be given by the writer in a subsequent article.

Ira P. Rowley, Artist-Editor of Stone.

QUARRY OF MAXWELL BLUESTONE CO., EUCLID DISTRICT.

THE NICARAGUA CANAL.*

A CANAL to cut the isthmus which unites North and South America is one of the prime commercial necessities of the age. Europe has led the way with the Suez canal, which saves a detour of thousands of miles around the Cape of Good Hope. Strange it is that the great man who accomplished so easily the Suez scheme overlooked the opportunities which nature furnishes in Nicaragua, where a large lake and a navigable river almost traverse the isthmus, leaving to man little more than to construct an inlet on one side and an outlet on the other.

That the leaders of our great political parties have each declared in their respective platforms in favor of the Nicaragua canal, reflects the growing public sense of the wide results of the undertaking. It would indeed be surprising if, at this day, such a feeling did not possess the American mind. Intent as we are on internal improvements, expansion is bound to be a dominant idea. Vastness of territory and resources, increase of population and phenomenal progress, with the splendid opportunities offered for trade with other countries, encourage the tendency, which is strengthened by everything done. Our river and harbor improvements are not merely local benefits, but so many steps toward a world-wide commerce. Our new navy is being built, not for menace, but for the protection of interests by land and sea, which are constantly growing. Our world's fair has an international bearing, and all around are signs of an increasing self-consciousness and realization of the part the United States is destined to play, not only within its own confines but in every direction. As a means of lifting our country to its proper place, commercial and political, before the world, no measure can possibly be taken equaling in importance the Nicaragua canal.

It is proposed in this notice, without excess of detail, to present as clearly and fully as may be, the leading facts which make the Nicaragua canal scheme a subject of unique importance to this country, as likewise, more or less, to the whole world. It is hoped that the description, by supplying geographical facts fascinating in themselves, will further help to enlist the

*Illustrations and text by courtesy of "The South" Publishing Co., New York, and Nicaragua Canal Construction Company.

intelligent interest of the people generally in favor of so magnificent a project.

As every one knows, the great continents of North and South America are united by a slender filament that, in its narrowest point is but fifty miles across. This puny barrier is at present as great an obstruction as though its breadth equaled the whole distance across the United States. Thus a vessel bound from New York to San Francisco must make the tedious and dangerous voyage around Cape Horn, amounting to nearly 16,000 miles, or if a full powered steamship, she might possible save some 2,000 miles by going through the tortuous Magellan Strait. Were the isthmus pierced by a canal, the whole route might easily come within 5,000 miles, with a corresponding reduction in time and expenses of voyage. For the Gulf ports of New Orleans, Mobile and Galveston, in trading with San Francisco and the countries south, the advantages would be far greater.

But not only would the trade of this country profit immensely by the canal, but commerce with Europe would be facilitated in an almost equal degree. The length of route to or from San Francisco around Cape Horn is practically the same for Liverpool as for New York, owing to the far eastward trend of the South American coast, which obliges vessels from American ports to take a mid-ocean course. For this reason the nautical distances from San Francisco to New York and to Liverpool are practically the same, the voyage being an average of 120 days. By the canal the voyage would be but half of this to Liverpool and still less to New York; the latter, besides having the advantage of the shortened route, being this side of the Atlantic, and thus, for trading purposes, beyond all foreign competition. For some time, dating from the discovery of this country, it was thought that there must be a channel through the isthmus, connecting the two oceans. None having been found, the next idea was to make an artificial route. As long ago as 1550, Antonio Galvao indicated a way via the San Juan river and Lake Nicaragua, as the most feasible. Nothing practical was done until recent years, when great enterprises were set on foot. The first to be named was that of Captain Eads, a very able engineer, whose opening of the Mississippi to deep sea vessels gave him a national reputation. He proposed to construct a railway across the Southern extremity of Mexico, by which ships might be hauled bodily from the Atlantic to the Gulf of Tehauntepec, on the Pacific. The idea lacked support, and died with the man. Ferdinand DeLesseps, the engineer whose recent failure should not detract from his fame in making Africa an island by the construction of the Suez canal, performed one of the most wonderful feats of modern times. Flushed with success, and realizing the transcendent importance of what he attempted, he tried in the Western world a similar experiment, to pierce the isthmus at its narrowest point. Hundreds of millions of dollars were

NICARAGUA CANAL—DREDGES WORKING, EMBA ... IN.

expended, and thousands of lives were lost, but, after all, his work is practically dead.

The writer is forcibly reminded, in this connection, of a notable remark of Ralph Waldo Emerson in one of his essays, contrasting the work of the engineers Brunel and Stevenson. The one drove a straight line through everything, the other "followed the river." This is precisely the difference between the abortive work of DeLesseps and that of the Nicaragua Canal Construction Company. De Lesseps attempted to drive his straight line through the isthmus; the company's engineers are taking nature's hints, and availing themselves of the aid she furnishes, first by a river and then by a great lake to reduce excavation to the minimum, and corroborate the idea of the Spaniard, uttered more than three centuries ago. Were all things equal it would matter little where the isthmus was divided, except that the further north the division is made the better for the United States. If nature has not furnished a route by which the ships of America and Europe can sweep across the ocean to China, Java or Australia, without going around the Horn, she has given at one point a blending of conditions which asks only a little of man's energy to break the barrier.

Nicaragua, one of the five states of Central America, lies between Honduras and Salvador on the North, and Costa Rica on the South. For present purposes its principal feature may be stated to be a great lake, occupying a large part of the narrow isthmus, and feeding a navigable river, the San Juan, which flows into the Atlantic; lake and river forming nature's most clearly indicated route for inter-oceanic communication. This is truly a wonderful provision, for while the lake (fifty-six miles of which may be used as a part of the canal) finds by the river an outlet on the Atlantic side, it has also on the Pacific side a natural channel which needs comparatively little improvement.

Greytown, fronting on the Caribbean sea is the point of entry from the Atlantic. The distance across to Brito, the chosen outlet on the Pacific, is 170 miles, but of this the bulk is free navigation by the San Juan river and Lake Nicaragua, so that the work of canal excavation is reduced to a bare twenty-seven miles. The Nicaragua lake, a veritable inland sea, 100 miles in length and 50 miles wide, with its river outlet to the Atlantic, is the great factor that makes the problem so easy. There are, however, some difficulties to be met besides the excavation of the twenty-seven miles of canal. Two or three rapids in the San Juan river will have to be overcome by rock blasting and dredging; but the river is a wide stream of some 30 to 130 feet in depth, able, with the removal of the obstructions named, to accommodate the largest sea-going vessels for sixty-five miles of the route.

It is evident that the main work of the company is at the points of entry and exit. On the Atlantic side the San Juan river, near its mouth, follows a

devious course, and it has been decided to abridge this route by a straight cut of twenty-five miles to a point on the San Juan named Ochoa. Ten miles of this will be easily made by dredging; a large part of the rest will be through basins created by damming the streams which flow across the line. Lake Nicaragua has a level of 110 feet above sea, and in order to graduate the difference a series of immense locks will have to be built, three on the Atlantic and three on the Pacific side, each 650 feet long and eighty feet wide, ample to receive two vessels of 2,500 tons each. These locks will all be of solid concrete masonry and iron. Beyond the third lock on the Atlantic side is one of the most difficult parts of the whole work, consisting of rock excavation through what is known as the Divide, or the highest point in the isthmus. The cutting is between two and three miles in length and averages about 140 feet in depth. The company has greatly improved the harbor at Greytown. Years ago this harbor admitted vessels drawing twenty feet of water, but gradually it was filled up and a high and dry sand bar stretched across the entrance. To open and maintain a practicable way, the company built a long breakwater, the effect of which was immediate. The bar on the leeward side of the breakwater was quickly breached by the sea, and a channel was opened which gradually deepened until in a few months a passage was made from the ocean to the harbor, admitting vessels of twelve feet draft. There is no serious engineering difficulty in maintaining a harbor at Greytown for all the ships that may hereafter take the Nicaragua route. At Ochoa the canal joins the San Juan river, and from that point to Lake Nicaragua, a distance of sixty-four miles, there is free scope for the largest steamers to pass each other without danger. The river enters Lake Nicaragua at Fort San Carlos. Some dredging in soft mud will be required at the lake's border, to get the required depth, which done, there is clear sailing across the lake for another fifty-six miles. At the further end of the lake seventeen miles of land must be crossed to reach the Pacific. A cut of five miles of lowland will have to be made to reach a body of deep water known as the Tola Basin. Beyond the basin will be three locks, bringing the level of the canal down to that of the Pacific ocean. Some work will have to be done in making a harbor at Brito, and a breakwater similar to that at Greytown has already been constructed.

The most competent engineers recognize the work as one of plain sailing. There are no great problems to be solved. As Mr. George W. Davis, the general manager, observes, "It comes down to a certain number of yards of rock to be excavated, a certain amount of earth to be removed, locks to be built, dams to be constructed and harbors to be created; in short, there are no physical or engineering difficulties whatever in the way." There is no experiment in the construction or operation of the locks. The United States government built the first great lock in the world, at Sault Ste. Marie,

NICARAGUA CANAL—STORE

and the success of this work has induced the building of similar locks in other parts, as notably in Holland and Germany.

The canal will allow a ship to pass from ocean to ocean in 28 hours. The total cost of the work, including everthing' is placed at $100,000,000, but this is considered within the mark, though it is only about the cost of the Suez canal; the time occupied in construction has been estimated at six years.

The Nicaragua Canal Construction Company has already done a great deal of work in furtherance of the enterprise. First, surveys were made which had to be approved by the Nicaragua government, which has all along, since 1825, desired the coöperation of the United States in the scheme. The Nicaragua government in 1887 made a concession of the right to build a canal to citizens of the United States. Under this concession the present company is operating. In October, 1889, the real constructive work began. After providing permanent quarters, as wharves, storehouses, etc., the company began by improving the harber of San Juan, or Greytown. The chief work is a breakwater for the protection of the entrance. This has been pushed out about 1,000 feet; the filling material for its completion will be supplied from the excavation at the difficult point known as the Divide cut, referred to above. It has been mentioned that upon the construction of the breakwater, the sea without any dredging made an open channel across the bar, permitting the entrance of light-draft seagoing vessels, where previously was a sand bank three or four feet above water. During the summer of 1889 permanent buildings were begun and construction has been going on ever since. The buildings at headquarters, which is in the vicinity of San Juan, or Greytown, are all of a substantial and important character. Everything in the shape of mechanical appliances has been provided in abundance. In 1890 the company was enabled to purchase the extensive and valuable dredging plant, etc., which was used on the defunct enterprise of DeLesseps. This consisted of seven dredges, the most powerful ever built, two fine tug-boats, twenty lighters, several launches, and a vast quantity of tools and material. The canal line has already been opened to the width of 280 feet and depth of 17 feet, for 3,000 feet from the harbor. The accomplished work of the company may be summarized as follows: It has completed all surveys. It has by boring ascertained perfectly the extent of the obstacles to be overcome in the canal work proper. It has made the harbor of San Juan del Norte, or Greytown, accessible for vessels of 20 feet draft, and proved that by dredging the harbor will admit the largest seagoing vessels. It has erected all the necessary warehouses and other buildings for its work. It has established telegraphic communication with New York. It has cleared the canal line of timber for 20 miles. It has built 11 miles of railroad to assist

in its work. It has demonstrated that the climate is no obstacle to its operations, and finally, it has satisfied the Nicaraguan government of the good faith of its project by the expenditure of $2,000,000 in the first year, confirming its title to concessionary rights for a term of ten years in which to complete the canal and open it for traffic,

The most important consideration, supposing the canal to be constructed, is the amount of traffic likely to be attracted when the canal is opened. That this traffic will be immense is best shown by the maps which illustrate the difference between the existing routes and those through the isthmus. A canal through Nicaragua will revolutionize the commerce not only of the United States, but of the whole world. For our own country the change will be astonishing. The distance from New York to San Francisco will be reduced from 15,000 miles to 5,000, and to all North Pacific points in proportion. To Acapulco, in Mexico, the distance, instead of 11,555 miles, will be reduced to 3,045 miles. To Callao, Guyaquil and Valparaiso, in South America, an average of about 6,000 miles will be cut off. In traffic with other countries we shall gain similar advantages. In going from New York to Hong Kong we shall save over 3,000 miles, and still more in trading with Australia and New Zealand. The saving to Yokohama, Japan, will be 6,000 miles. Our South Atlantic and Gulf ports will, of course, enjoy even greater advantages, and secure for themselves a large share of this newly developed trade. A glance at the map, supposing a route cut through the American isthmus, will show better than would any further figures the immense advantage to the trade not only of America but of the world at large of this great and truly international work.

We can only call attention to some of the industries which will find a new and more profitable market for their products by the opening of the canal, and may safely assert that the most enthusiastic imaginations cannot exaggerate the extent of the possibilities of this new trade, fostered by cheapened and quicker methods of transportation.

Coal is very scarce on the Pacific coast, and commands high prices. The coal fields of the South, adjoining the seaboard on the Gulf, can ship their coal to the western coast of North and South America cheaper than Europe or Australia can do so. The canal itself will become a very large consumer of coal, as its terminal points will no doubt be used as coaling stations for vessels. Port Said the coaling point at Suez, consumes 1,500,000 tons annually. It may be safely predicted that when the canal shall be opened, the coal fields of Alabama and the South will command the entire coal market of the Pacific ocean.

The iron industry now progessing favorably in the South, yet hampered by want of suitable markets, will be quickened into new life by having at its doors the markets of the Pacific.

NICARAGUA CANAL—BUILDING RAILROAD THROUGH SWAM

The great staple of the South, cotton, whose cultivation has been so unprofitable of late years, owing to excessive production, would find a new market in Japan and China, where modern spinning mills have been erected, and where, even under present onerous conditions of transportation, American cotton is beginning to be used in preference to the Indian product. It may not be generally known that for the last three or four years shipments of raw cotton have been made from New York to Japan over the Canadian Pacific railway and the English Pacific steamship line in steadily increasing amounts, as will be seen from the following table taken from the statistics of imports to Japan :

1888	84,257 pounds.
1889	95,204 "
1890	2,366,099 "
1891	7,072,562 "

In fact, there are 40,000,000 people in Japan, and 12,000,000 in Corea, besides untold millions in China, who wear little but cotton, and we could secure there a market for either our raw or manufactured product if the markets of those countries were brought as near to us as they now are to European ports by the Suez canal; and the Nicaragua canal will bring them much nearer to our Southern ports than they are at present to their European source of supply.

There is no necessity for further argument to demonstrate that untold advantages are to accrue to the South from the opening of the trade of the Orient.

The question has often been asked, "Will the Nicaragua canal pay as a commercial enterprise?" Probably the best answer to this question is found in the example of the Suez canal, which saves a maximum distance of 3,600 miles, while the Nicaragua canal saves as much as 10,000 miles between the points on our own continent, and not less than 6,000 miles between Japan and New York. In round figures, the cost of the Suez canal was $100,000,000, the estimated cost of the Nicaragua canal. The growth of its tonnage and revenue for a series of years is exhibited in the following table :

Year.	*Tonnage.*	*Receipts.*
1870	436,609	$ 869,151
1875	2,009,984	5,526,291
1880	3,057,421	7,298,524
1885	6,335,752	12,011,452
1890	6,890,094	13,396,800
1891	8,699,020	16,684,300

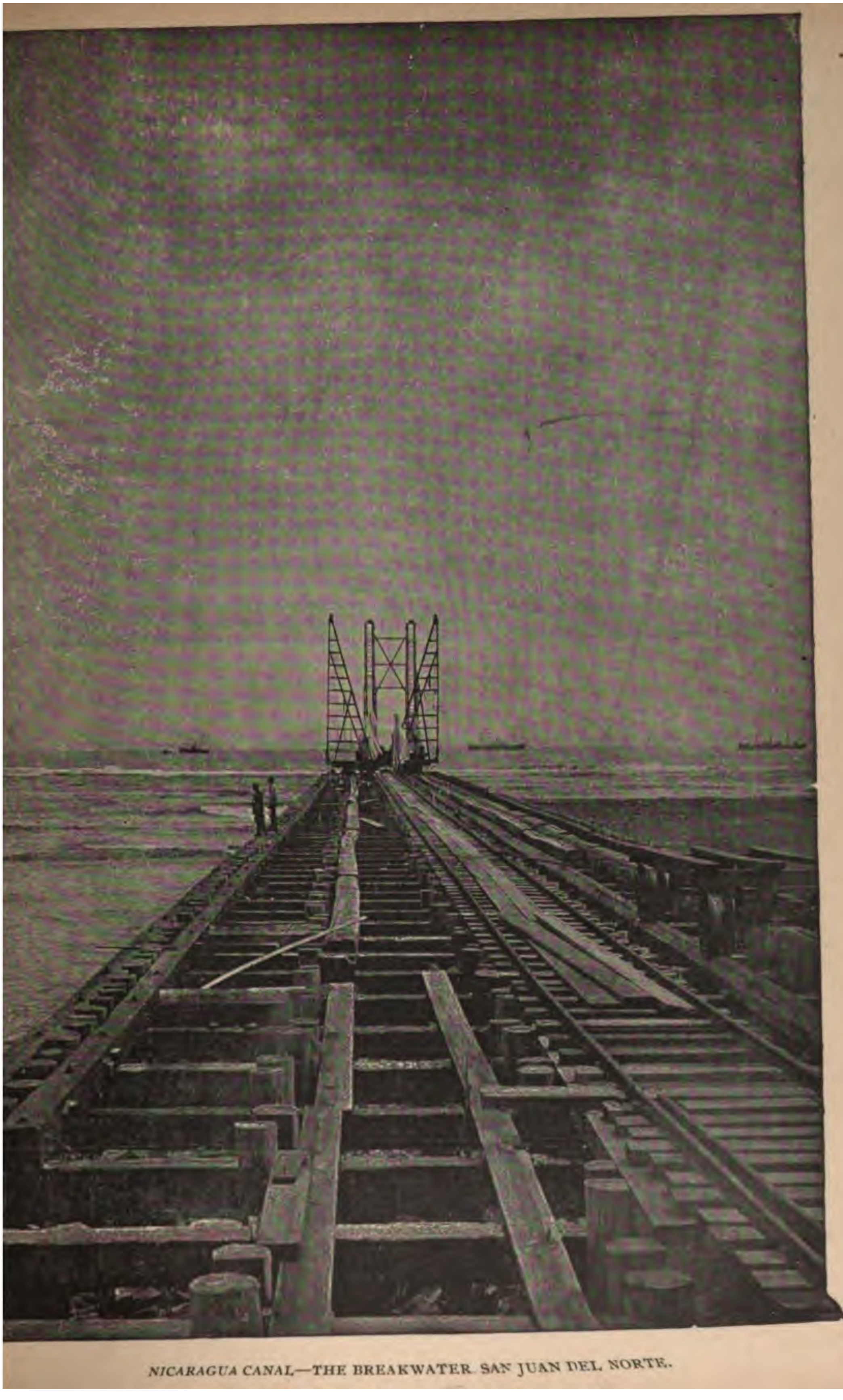
The receipts for a single day in 1892 have been 350,000 francs. In 1888, which may be taken as an average year, the cost of maintenance and operation of the Suez canal was a fraction over $1,000,000. The annual net rev-

enues of the company for a series of years have been upwards of $12,000,000, and for the present year they are estimated at $15,000,000.

Interest on the obligations and dividends on the stock of the company are regularly paid, and the quotation for the $100 shares, par value, of the Suez company on the Paris Bourse is $560. The dividends paid on the shares last year were over 20 per cent. on their par value.

The official reports of the tonnage now existing which is tributary to the Nicaragua canal and which would pass through it within two years after its opening, is a little more than 8,000,000 tons per annum. If only 6,000,000 tons per annum should pass through the canal at the beginning, the income at $2 per ton, which is the charge now made by the Suez canal, would amount to $12,000,000 annually. There can be no doubt that within five years of the opening of the canal the tonnage will be nearer 10,000,000 than 6,000,000. The cost of maintenance, operation, etc., can safely be placed at an amount not to exceed $1,000,000; thus an annual traffic of 6,000,000 tons will show a net income of $11,000,000, or 5½ per cent. on a capitalization of $200,000,000.

The ablest engineers of the United States and England have given it as their opinion that the cost of the canal cannot under any condition exceed $100,000,000, which sum includes interest upon the money during the process of construction. It is believed by many of the leading men engaged in the transportation business that the opening of the canal will in five years double the population and quadruple the exports of the Pacific coast.



NICARAGUA CANAL—THE BREAKWATER. SAN JUAN DEL NORTE.

NICARAGUA CANAL—DIAMOND DRILL BORING PARTY.

LAKE NICARAGUA, SHOWING ISLAND PEAKS OMETEPE AND MEDERA.

CRUSHING STRENGTH, ELASTIC LIMIT, ETC., OF BRITISH BUILDING STONES.*

VERY few systematic tests of the various properties of British building-stones have been published since the report of the Royal Commission of 1839 was issued. The commission was appointed to inquire into the question of "the selection of stone for building the new Houses of Parliament"; it issued a very valuable report on the stones then chiefly in use, and the results of the experiments they carried out have formed the standard of reference up to the present day. It is a well known fact, however, that the qualities of the stone from any particular quarry are by no means constant. As many new quarries have since been opened, also, it seemed that the time had come for a new series of experiments.

The author determined to carry out tests on the following properties: Crushing strength, density, absorptive power as a test of weathering, and an inquiry into the behavior of stone under gradually increasing pressures with a view to determining the modulus or coëfficient of elasticity.

The author put himself in communication with a large number of quarry owners throughout the country, with the object of obtaining specimens, and met with a very cordial response. Naturally, only a selection could be made of all the quarries now worked, but he endeavored to obtain as representative a collection as possible. Three specimens of each stone were asked for, in the form of 2¼ inch cubes, as such a cube of the stronger granites was the maximum size which could be crushed in a testing machine of 100,000 pounds capacity.

The building-stones in ordinary use may be classed as granites, limestones, dolomites and sandstones. As far as possible, specimens of these classes were obtained from each district where they occur. After the specimens were received they were allowed to remain for some time exposed to the dry, warm air of the laboratory, till practically all the natural quarry water had been evaporated, and it was in this condition that all the measurements and experiments were made. The general plan adopted was to test one of the three specimens at once for crushing strength; to use a second for density, absorption, etc., experiments and then to crush it; and to employ the third for elastic tests before crushing it.

The crushing tests were carried out in the large Greenwood & Batley testing machine belonging to the laboratory of University College, London; a

*A paper by Thomas Hudson Beare, Asso. M. Inst. C. E. condensed from Proc. Inst. C. E.

horizontal machine of 100,000 pounds capacity. In all cases the load was applied gradually up to the maximum point.

The specimens were carefully prepared at the quarries, so as to insure parallelism of the two sides, and the specimens were placed in the machine in such a way that the axis of pressure was perpendicular to the planes of the quarry bedding.

The faces of the cube to which the pressure was applied (in addition to the careful quarry preparation) were strickled over in the laboratory with a thin layer of plaster of Paris; when this was dry, it was easily rubbed and pared to a smooth surface, and to perfect parallelism of the two pressure faces. The surfaces thus prepared were applied directly to the steel faces of the dies of the testing machine, nothing whatever being interposed. This is a point of very considerable importance in the testing of stone and similar materials, and it appears to the author that many of the very discrepant and anomalous results so often obtained in such tests may be easily explained by consideration of the methods adopted for holding the specimens in the testing machine.

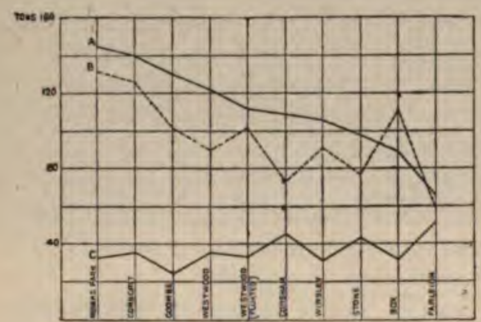


FIG. I. EFFECT OF ABSORBED WATER ON CRUSHING STRENGTH OF BATH STONE.

A. Crushing strength. B. Ditto, after immersion in water for seven days and redrying. C. Percentage of water absorbed.

It has been a common practice to interpose between the specimen and the dies of the machine sheets of lead or thin pieces of soft wood, with the idea that this would secure a perfectly uniform pressure all over the cube, in consequence of the softer lead or wood yielding and thus accommodating itself to inequalities in the pressure from want of parallelism or roughness in the two faces of the cube. It is, however, quite certain, whether the above result is obtained or not, that the introduction of the lead or wood very largely reduces the crushing strength of the specimen, and the reason is not far to seek. The compressive forces produce lateral dilatation, and consequently a tension at right-angles to the line of pressure; now under the great pressure necessary the lead flows laterally, and the friction thus caused between it and the face of the cube sets up a very considerable tensile stress additional to the one mentioned above, the result being that the cube is torn asunder into a series of prisms parallel to the axis of pressure by this augmented lateral tensile stress, and the fracture is quite unlike the typical one of stone or such material when crushed in the form of cubes. The author investigated this point, and determined the resultant

loss of strength in using such interposed sheets of lead, etc., by a series of comparative tests, the results of which are given in the subjoined table.

The enormous reduction of strength, varying from 36 to 55 per cent., is very apparent, and the fact that the loss is greater the stronger the stone, points very clearly to its origin, viz., the lateral flow of the lead under the great pressure to which it was subjected. The use of thin pieces of soft pine is still more destructive. Three specimens of Corncockle were tested; two with lead interposed had a mean strength of 195.1 tons per square foot, while one with pine carried only 145.4 tons before breaking up into a number of prisms.

The author is therefore of opinion, that, for the sake of obtaining accurate and uniform results, stone cubes should always be prepared and tested in the way adopted in these experiments; in a few cases he interposed between the die and the plaster of Paris face millboard (which is practically incompressible at the pressures used), but it did no good, and if anything, harm. There is no necessity for anything, except the thin layer of plaster of Paris, which, to all intents and purposes, becomes part of the stone cube.

These interesting results emphasize also very clearly the effects of bad bedding in structures in reducing the strength of the stones used.

INFLUENCE OF INTERPOSED LEAD SHEETS ON THE STRENGTH OF STONE CUBES.

Name of stone:	*No. cubes.*	*Method of bedding.*	*Crushing strength.* Tons per square foot.	*Loss of strength by use of lead.* Tons per sq. foot.	P. c.
Binnie	1	Lead ⅛ in. thick.	253.4	154.1	37.8
"	2	Plaster of Paris.	407.5		
Hermand	1	Lead ⅛ in. thick.	253.4	130.7	35.5
"	2	Plaster of Paris.	393.1		
White Hailes	1	Lead ⅛ in. thick.	298.1	369.3	55.3
"	2	Plaster of Paris.	667.4		
Arbroath	3	Lead ⅛ in. thick.	321.1	237.0	42.5
"	3	Plaster of Paris.	558.1		
Craigleith	3	Lead ¼ in. thick.	408.9	453.0	52.6
"	3	Plaster of Paris	861.9		

Note.—For the first three stones the cubes were all cut from one block. This was not the case for Arbroath or Craigleith, the second sets being obtained at a later date.

One cube, or in some cases two cubes, were, after drying in the laboratory, tested at once to destruction. These may be recognized in the appended tables, in which all the results are given, by the absence of any figures in the columns for the other tests. It so happened that the first stones tested were Bath and other oolitic limestones, and the author found that there was apparently some reduction of strength caused by the immersion in water and subsequent redrying; he, therefore, as far as this class of stones was concerned, abandoned this plan, and tested two samples of each set at once to destruction, reserving the third as before for elastic work. For the absorption tests two other cubes of each stone were obtained from the quarries

and eventually crushed. No such effect was found in the case of the sandstones, dolomites, or granites, and with them, therefore, the original plan was adhered to. Whether there really was a loss of strength is not quite certain; the curves in Fig. 1 show graphically the strengths of the two series of Bath stones, and it will be noticed that the curve indicating the

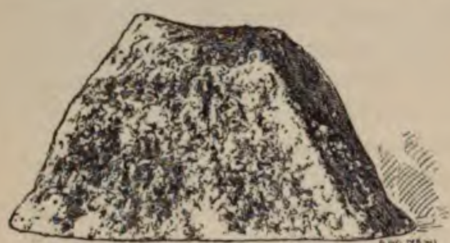


FIG. 2A. POLMAISE SANDSTONE.

FIG. 2B. PORTLAND STONE.

FIG. 3A. BATH STONE.

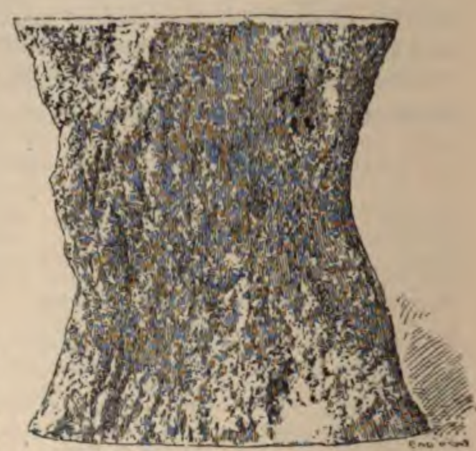


FIG. 3B. HAM HILL STONE.

crushing-loads for the immersed and redried cubes does show a distinct tendency to fall below the one for the series which was not placed in water; Fig. 1 also shows by another curve the relative absorptions of the different stones.

In general, there was no preliminary cracking noticeable. Most of the stones gave way quite suddenly and the type of fracture was that shown in Figs. 2 and 3, which are photo-zincographic reproductions of fractured cubes. Let a cube or other solid be subjected to direct compressive forces, and on any plane section inclined to the axis of pressure; there will be on this plane a normal component and a tangential component of the axial pressure. The latter will tend to produce shearing strain on this plane, and were it the

only internal force present it can easily be proved that it would reach its maximum value on planes inclined at 45° to the axis; but there can be no doubt that the normal component interferes with this by producing a resistance to the rubbing of the two surfaces over one another in the act of shearing. The plan at which shear does take place is therefore often not inclined at 45° to the axis; furthermore, the lateral dilatation before mentioned effects the result, causing the sides often to break off into prisms.

Were the maximum shear to occur on planes at 45° to the axis then the cube would tend to break up into six pyramids with their apices at the center. Generally the two corresponding to the top and bottom faces (i. e., the ones in contact with the dies) remained intact, and could be removed from the machine; but the others usually crumbled into irregular pieces or dust. In several cases, however—notably the oolites—the side pyramids also remained unbroken, the fracture being quite perfect.

In the tables, the stones are grouped under the four heads of sandstones, dolomites, limestones, and granites, and also largely in districts. It will be seen that the figures for crushing-loads are very closely concordant, and largely they speak for themselves. The mean crushing-strength for each class may, however, be useful. It was as follows:

MEAN OF CRUSHING STRENGTH.

	Varieties.	*Samples.*	*Tons per square feet.*	*Pounds per square inch.*
Granites	13	49	1,122.2	17,500
Oolites*	18	57	141.3	2,200
Sandstones	25	88	489.8	7,620
Dolomites	4	16	500.5	7,800

*This mean does not include limestones which are not oolitic, and does not include the immersed and redried oolites.

As a rule, the results are higher than in the older experiments, and agree better with each other. In the case of Bath stones, two means have been given: the one in brackets is for the cubes of each set, which were not immersed in water, while the other includes them all. Every test which was made is included in the tables.

For density test each cube was accurately measured to obtain its exact cubical contents, and carefully weighed; then this weight was compared with the known weight of an equal volume of water at the standard temperature. The very close agreement of the results where two or more cubes of one kind of stone were tested is sufficient proof of the carefulness and accuracy of these results. In the case of the granites, since the absorption of water is exceedingly small, the specific gravity of density was also determined by weighing the cube in the air, and then in water; this method

also gave very close results, and in strict agreement with those obtained by the other plan. The weight per cubic foot has been calculated from these density results, assuming one cubic foot of water to weigh 62.42 pounds; the mean density is used for the calculation where there are several results.

For the absorption of water tests, the cube, after it had been measured and weighed as above described, was lowered gradually into a vessel of water (earthen-ware crocks were used), and left for a period of six or seven days. Saturation probably occurs within a very few hours, but it is safer to leave the cube under water for some days. At the end of this time the stones were removed, wiped with a dry cloth to remove adherent water, and at once reweighed. The gain of weight compared with the figures for the dry stone is that due to the water absorbed. In column seven of the tables, the results are expressed as a percentage of the original weight, by dividing the gain by the dry weight. It may be mentioned that every care was taken to have the stones thoroughly dry

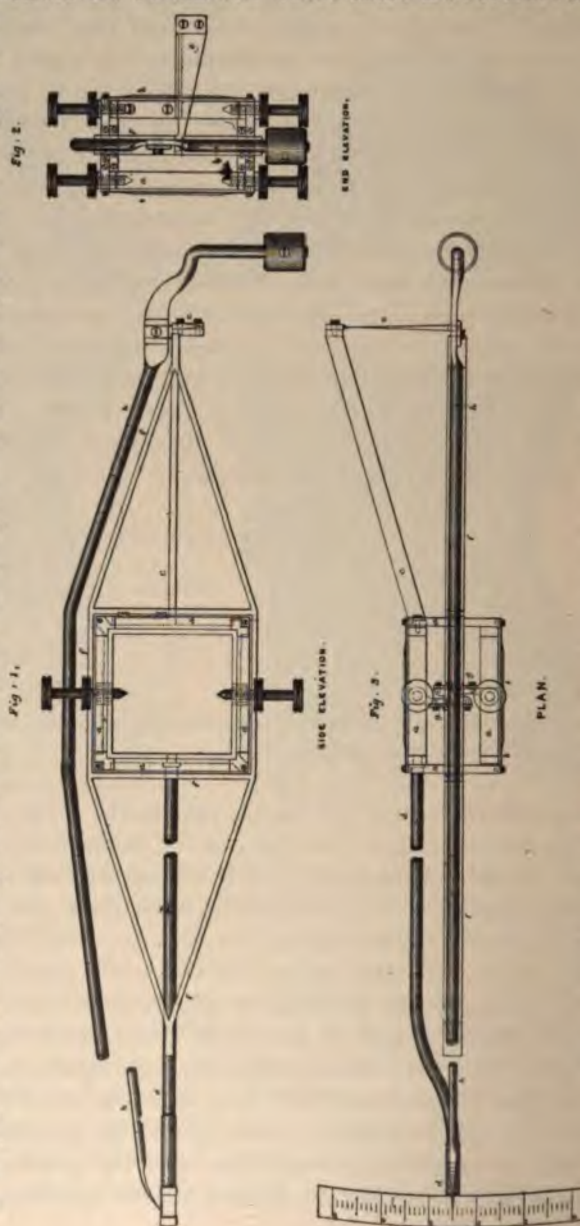


FIG. 4. APPARATUS FOR MEASURING THE ELASTICITY OF STONE CUBES.
Designed by A. G. Ashcroft, Assoc. M. Inst. C. E.

before beginning these tests, and they were allowed to again dry before crushing them. The water used for a few of the earlier specimens was drawn from the college service-supply, but for all the others, pure distilled water was used.

That there was some dissolving action going on in the case of the oolites was shown by the condition of the water in the vessels after the stones were removed. It was slightly cloudy, and there was a distinct sediment. This is quite sufficient, probably, to account for any apparent loss of strength.

Of course, to be at all comparative, absorption tests must be made on cubes of the same size, so that the surfaces exposed to the water may bear the same relation to the volume of the cube. It is, therefore, not easy to compare one set of observations with another; in this case they are strictly comparable, as all the cubes were of the same size, and treated in precisely similar fashion. The relative amounts of absorbed water must be a very good guide to the relative weathering power of stones, since it shows to what extent deleterious agents in rain water and fogs will penetrate the stone, and, furthermore, a freely absorbent stone must be very liable to the destructive action of frost. Summarizing again, in order of absorption, oolites (average of 27 samples), absorb 8.06 per cent. of their dry weight; dolomites (average of 4 samples), 5.43 per cent.; sandstones (average of 26 samples), 4.68 per cent.; granites (14 samples), 0.27 per cent.

Fig. 1 shows diagrammatically for Bath stones the relation between absorption and strength to resist crushing, and also the apparent resultant loss of strength. There are two sets of cubes of Westwood Ground, one set having been treated by Mr. Kessler's process for hardening and preserving calcareous stones. The effect of its application seems to be a slight reduction in strength, with also a slight lowering in the quantity of water absorbed. The process is largely used in France, and seems to be very successful in reducing and checking decay of oolite and other limestones.

It is a matter of extreme difficulty to obtain coefficients of elasticity for stone. The specimens operated on are necessarily small, and the quantities to be measured very minute. It is a difficult enough matter to obtain thoroughly trustworthy results when dealing with iron and steel, the specimens of which can be made in lengths of 10 inches and upward; when dealing with only 2½ inch cubes, it becomes impossible to use any ordinary strain-measuring apparatus. The author, therefore, requested his assistant, Mr. A. G. Ashcroft, Assoc. M. Inst. C. E., to undertake the devising of a measuring gear, for use with these small cubes, capable of magnifying about 2,500 times. The essentials were, the gear must be very sensitive and free from all inertia and resultant backlash. After several trials, the apparatus shown in Fig. 4 was elaborated, and was finally used in all these tests.

The principle on which the gear is arranged is to obtain the needful mag-

nification by a system of levers, that is, by mechanical exaggeration, and not by optical means. A brass frame, a, embraces the cube, and is attached to it at the top and bottom by two pairs of set screws; the centers of these

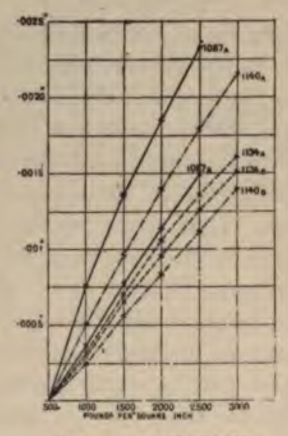


FIG. 5. SANDSTONE.

1087_3 Prudham... { A. First test. B. Second test.
1134_3 White Plean { A. First test. B. Second test.
1140_3 Dean Forrest { A. First test. B. Second test.

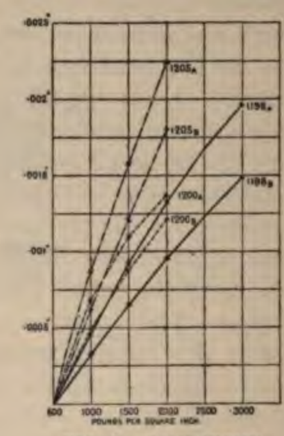


FIG. 6. SANDSTONE.

1198_3 Darley Top.... { A. First test. B. Second test.
1200_8 Bramley Fall... { A. First test. B. Second test.
1205_3 Aspatria...... { A. First test. B. Second test.

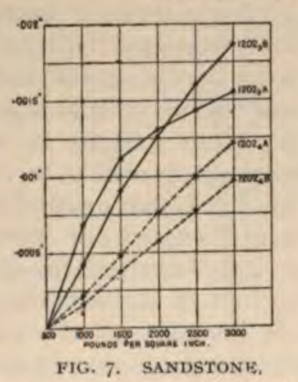


FIG. 7. SANDSTONE.

1202_8 Lightcliffe Bed, { A. First test. B. Second test.
Plane of pressure parallel to bedding.
1102_4 Lightcliffe Bed, { A. First test. B. Second test.
Plane of pressure perpendicular to bedding.

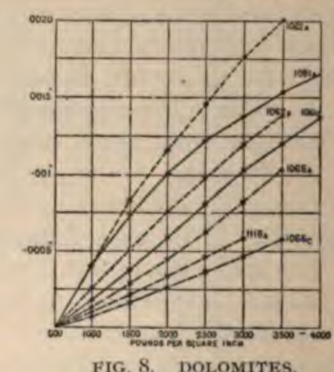


FIG. 8. DOLOMITES.

1061_2 White Mansfield ...... { A. First test. C. Third test.
1062_2 Red Mansfield......... { A. First test. F. Sixth test.
1065_2 Brown Weather Bed.... { A. First test. C. Third test.
1118_2 YellowMagnesianLimestone. { A. First test.

pairs are exactly 1½ inches apart; this forms the length on which the compressions are measured. The brass frame as is made in two pieces, each

piece being a square frame with two uprights at opposite ends of one diagonal, thus the two pieces when placed together form a hollow prismatic frame; the two parts are secured together and united, with freedom to move relatively to one another, by eight spring pieces, b. One of the two sides of a, supports on one side an arm c, and on the other a long arm d, with a

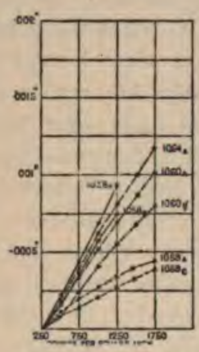


FIG. 9. LIMESTONES.

1058_3 Doulting Fine Bed ...... { A. First test. B. Second test.
1059_3 Doulting Chelynch Bed .. { B. Second test. C. Third test.
1060_3 Ham Hill .... { A. First test. B. Second test.
1064_2 Ancaster Freestone ...... { A. First test.

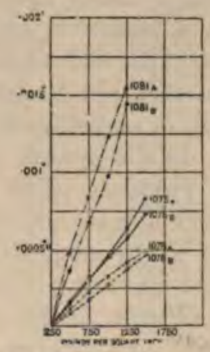


FIG. 10. BATHSTONES.

1075_1 Monks Park . { A. First test. B. Second test.
1078_1 Corngrit .... { A. First test. B. Second test.
1081_1 Westwood Ground ..... { A. First test. B. Second test.

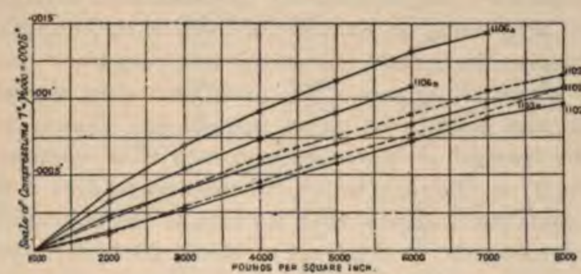


FIG. 11. GRANITE

1102_3 Aberdeenshire, Peterhead .... { A. First test. B. Second test.
1103_3 Aberdeenshire, Dyce .... { A. First test. B. Second test.
1106_3 Aberdeenshire, Hill of Fare . { A. First test. B. Second test.

scale attached to it; the arm c carries at its end at right angles to itself a small piece of steel e, the attachment being a spring one; on the end of e is a center dot. Surrounding the frame a, is a cross frame f, which is made double for balancing purposes; this cross frame is attached by spring pieces of the "Emery" type (which take the place of knife edges) g, to each of the

two halves of a; on the end of this cross frame, close to the piece e, is another center dot. Any compression of the stone cube will cause the cross frame to move relatively to the arm c, and the distance apart of the two "Emery" springs being 0.3 inches, while the horizontal length of c is 7 inches, there is a resultant exaggeration of the cube's compression, at the center dots, of about 23-fold. Resting by means of needles in the two center dots is a pointer h, whose length is 100 times the distance between the two needles; the end of the pointer as it moves over the scale has, therefore, a motion 100 times as great as that of the center dots relatively to one another, or magnifies between 2,300 and 2,400 times the compression of the cube. By the system of springs used throughout in the construction, and the lightness of all the parts, the author believes that all back-lash has been eliminated, and the gear is extremely sensitive; it also accommodates itself to any inequalities in the pressure. The actual magnification was determined by testing it against the laboratory standard gear on a piece of cast iron prepared for the purpose. It proved to be 2,358 times. This calibration gave also an opportunity of testing its delicacy and accuracy before using it with the stone cubes.

The method of carrying out the tests was as follows: A load was applied sufficient to keep the specimen with the gear attached in its position in the machine between the ties, and the corresponding scale reading was taken as zero; this load varied from 250 pounds to 1,000 pounds per square inch. This plan was adopted to prevent any possibility of derangement of the gear by shocks, in putting on and off the load, such as might occur if the pressure had been entirely removed, and it was easy to let back the load to these amounts when taking sets. The loads were then increased gradually by 250 pounds, 500 pounds, or 1,000 pounds per square inch, at a time, according to the strength of the stone, and each time readings of the position of the pointer on the scale taken, till the highest load it was desired to apply was reached; the load was then let back to the starting lead, and the permanent set measured. A fresh set of observations was then made with this new zero, the same method of procedure being followed. In a few cases still further series of readings were made; but as in most cases, the additional permanent set produced by the second application of the load was extremely small, these additional series were not made unless something anomalous had occured.

The results are given in columns 8, 9 and 10. The coefficient again illustrates the effect of the more compact arrangement due to the natural crystalline character. The mean for the limestones (omitting 1,059), are 133,530 and 150,750 tons per square foot; they are thus for the first test of nearly the same value as those for the sandstones in the state of ease.

The granites are illustrated in Fig. 11. The range of stress is, of course

CRUSHING STRENGTHS, ABSORPTION, DENSITY, CO-EFFICIENTS OF ELASTICITY, ETC., OF BUILDING STONES.

Condensed from Tables of Thomas Hudson Beare.

No. Tests.	*Name of Stone.*	*Mean crushing load, per sq. ft., tons.*	*Mean Weight, 1 cu. ft., lbs.*	*Absorption. Per cent. dry weight.*	Co-efficient of elasticity for pressure. *First time load applied. Tons per sq. ft.*	*Reapplicat'n l'd. Tons per sq. ft.*
			SANDSTONES.			
4.	Prudham	455.3	142.5	4.00	78,200	125,300
4.	"	455.3	142.5	4.32	91,960	109,200
3.	Corncockle	383.8	132.6	4.57	138,700	156,300
3.	Gunnerton	354.6	130.8	5.16	109,400	111,950
3.	Cragg	573.8	136.1	4.13	124,800	153,300
8.	Corsehill	444.9	130.4	7.94	101,600	121,000
5.	Polmaise	551.5	141.7	4.58	119,600	138,100
3.	White Plean	612.8	138.2	4.25	146,600	157,400
3.	Arbroath	558.1	151.0	2.32	134,600	164,800
3.	Auchinlee	203.6	128.9	6.90	62,900	84,080
3.	Craigleith	861.9	138.6	3.61	....	....
3.	White Hailes	662.0	143.8	3.71	78,780	105,100
3.	Dean Forest	530.0	151.4	2.71	113,600	172,000
3.	Gatelawbridge	495.7	129.5	5.84	143,600	168,100
3.	Blue Hailes	459.7	143.2	4.70	54,290	86,960
3.	Binnie	569.1	135.1	5.22	124,200	152,300
3.	Hermand	457.4	142.6	4.70	150,100	191,900
3.	Howley Park	466.7	140.3	4.90	83,700	116,500
3.	White Grinshill	209.3	122.5	7.80	101,000	115,500
3.	Darley Top	516.7	139.0	3.40	120,200	160,200
3.	Hercules Ridge	335.7	138.0	3.60	154,200	171,200
3.	Bramley Fall	238.4	132.2	3.70	106,800	114,900
3.	Ackworth	389.1	140.7	5.00	61,960	90,960
3.	Robin Hood	574.0	144.6	3.90	127,200	132,200
3.	Aspatria	233.9	123.2	8.50	64,990	80,100
4.	Lightcliffe	1020.5	149.6	2.30	191,600	241,400(f)
			DOLOMITES.			
4.	White Mansfield	461.7	140.1	5.01	209,800	235,600(d)
4.	Red Mansfield	591.9	143.2	4.58	137,100	198,700(e)
5.	Yellow magnesian limestone.	577.4	145.4	4.62	406,100	....
3.	Anston	301.9	132.2	7.50	229,800	350,000
			LIMESTONES.			
4.	Ancaster	552.6	156.3	2.42	289,700	499,800
3.	Portland base bed	287.0	137.6	6.84	....	....
3.	"	146.8	124.5	11.10	....	....
3.	Portland white bed	204.7	132.3	7.51	236,900	....
3.	Ketton	101.7	127.9	8.10	141,300	156,900
3.	Limestone (crystalline)	956.2	174.7	....	....	....
2.	Corsham Down	109.5	131.6	....	61,980	116,000
3.	"	94.5	127.6	11.12	72,460	....
5.	Farleigh Down	62.5	120.5	12.64	147,000	166,100
5.	Monks Park	139.6	136.7	7.74	....	....
5.	Box ground	97.5	127.9	8.10	138,700	129,200
5.	Coombe Down	117.7	128.6	6.19	....	....
5.	Corngrit	134.5	133.6	8.72	109,300	....

5.	Stoke ground..............	90 0	126.3	11.14	164,000	....
5.	Winsley ground	100.7	132.9	7.74	164,000	....
5.	Westwood ground..........	110.2	130.3	9.12	62,300	128,900
5.	Westwood ground (flated)...	111 5	132.3	8.46	....	....
		106.9	.....	7.61	....	....
5.	Doulting fine beds..........	111.6	125 0	10.70	97,580	121,000
		103.9	.....	11.05	....	....
5.	Doulting Chelynch beds....	180.8	150.4	3.42	357,600(e)	379,000
		.....	.....	3.30	....	....
3.	Ham Hill..................	166.3	136.0	....	140,600	164,500
4.	Ancaster freestone..........	184.0	140 4	6 27	120,100(b)	130,500
			GRANITES.			
5.	West of England Penrhyn...	1060.2	165.4	0.12	....	....
3.	Cornish Grey.............	955.9	161.7	....	463,500	538,300
2.	Aberdeenshire.............	1234.3	162.9	0.38	....	....
3.	Corennie..................	1318.3	159.1	0.42	523,600	540,700
3.	Aberdeenshire Cove.........	987.1	169.1	0.55	....	....
3.	Aberdeenshire Kemnay.......	1088.5	164.1	0.42	....	....
		1211.1	161.0	0.21	....	....
3.	Aberdeenshire Craigton.....	1282.0	.....	....	....	....
3.	Aberdeenshire Peterhead....	1207.7	158.5	0.29	644,000	657,000
3.	Aberdeenshire Dyce........	1105.8	165.4	0 19	587,600	621,400
3.	Aberdeenshire Hill of Fare..	1360.3	160.4	0.40	....	....
		......	157.9	....	381,000	460,400
3.	Aberdeenshire Sclattie......	850.5	161.0	0.10	266,000	321,700
3.	Aberdeenshire Persley grey.	942.8	162.3	0.19	522,300	....
3.	Aberdeenshire Rubislaw....	1098.8	163.7	....	445,000	525,200
3.	(a).........................	1289.7	.....	....	....	....
3.	Ben Cruachan	876.9	171.6	0.19	....	....

Note.—1 ton (of 2,240 pounds per square foot.) = 15.56 pounds per square inch whence a modulus of 100,000 tons per square foot = 1,556,000 pounds per square inch.

(a) Obtained from rock 177 feet beneath the surface. (b) Second application of load. (d) Third application of load (e) Sixth application of load. (f) Another sample showing almost identical qualities otherwise, had a coefficient of only 127,800 tons on reapplication of load. Result of first application not recorded.

much greater, but they also exhibit the above characteristics. Much less set was produced by the first loading; this is seen by the closer approximation of the two values of the coefficient of elasticity. The value of the coefficient is for the first test 479,000, and for the other test 522,100 tons per square foot, or in pounds per square inch, 7,450,000 and 8,121,000, respectively, about a quarter of the corresponding values for steel.

The author believes these figures will be of considerable interest and importance when the design of structures is being dealt with, where great weights have to be carried on foundations or by piers and columns, and as also affording data for calculating the stresses thrown upon masses of masonry by expansion and contraction due to changes of temperature. It had originally been intended to also deal with these constants by means of transverse tests, and to extend the inquiry into the transverse strength of some of the leading stones. Pressure of work has necessitated the postponement of this and a few other points, but it is proposed to undertake the inquiry very shortly. Enough has been done to show the value,

necessity, and importance of systematic tests of stone when being used in large works. Engineers, who would never dream of employing iron and steel without careful tests, accept large quantities of stone without any form of test, trusting merely to a casual examination. Although stone is not subject to the imperfections and carelessness of manufacturing processes, still, like all natural substances it varies greatly in quality, and hence the need of tests is just as great as in the case of manufactured articles.

The preceding table is very considerably abridged from the table which concludes the paper in the Proceedings Inst. C. E. in the following respects:

1. In omitting all record of the laboratory numbers.

2. In omitting all records of the separate tests for crushing load, but only giving the mean.

3. In omitting all record of the separate tests for density, but only giving the average. As a rule, as might be expected, the specimens having only a little greater density showed a very marked increase in crushing strength. For example, the eight specimens tested of Prudham sandstone (the first in the table) compared as follows:

Mean crushing load: Tons per square foot.

473.8	303.8	517.3	451.2	454.2	408.5	472.4	468.2

Density (for those stones whose density was taken):

....	2.27	2.30	....	....	....	2.31	2.25

4. In omitting the column of range of stones in the elasticity tests. As the accompanying diagrams show the stones displayed substantially the same laws (though not the same coefficients by any means) as metals do. The usual range of the sandstone, dolomite and limestone tests were from 32 to 192 tons per square inch, though some, lacking sufficient crushing strength, were only tested up to 128 tons, or even 64 tons. The first dolomite given was tested for elasticity up to 257 tons. The granites were mostly tested from 64 up to 514 tons, though the first and fourth above the last were tested only to 386 tons, and the third above the last to 257 tons only.

It will be seen that the granites have a very high modulus of elasticity, averaging about one-fourth that of steel. The sandstones were from 15 to 20 times as compressible as steel, or 4 or 5 times as compressible as granite. The fact that the modulus is so increased after the first test is a curious one, never before observed to our knowledge, though fairly inferable from the behavior of metals.—*Engineering News.*

PLEASED A YEAR.

"We have been much pleased with STONE during the past year, and think it an excellent magazine."—*M. N. Hambleton, Huntington, W. Va.*

THE TRANSPORTATION PROBLEM.

THE stone producers and dealers of the East and of the West have some interest in the long waterway that connects the great lakes with the sea. For many years the Erie canal has been a powerful factor in the regulation of rates of transportation from Lake Erie to the Eastern markets, and upon its maintenance has depended, to a great degree, the competition which has controlled freight rates from West to East.

It is not good news to the shippers of either section, that traffic on the Erie canal is in a serious decline. The business on that important waterway has fallen off greatly of late, and this year, according to creditable reports from Buffalo, it is in a worse condition than ever before.

It does not appear to be due entirely to the railroad competition that the boatmen have become discouraged. It would be cheaper to carry freight by water than by land, under favorable circumstances; but it appears that it is now impossible for the canal boats to carry full loads on account of lack of water in the canal. One of the boatmen says that if the depth of the water could be increased to about seven feet there would be a profit in the canal business, because that would enable the boats to carry larger loads, and thus their profits would be increased. But there seems to be little likelihood that the canal will be improved. There is a strong feeling in New York against such an expenditure of money as this would require.

Some idea of the straits to which the canal men are reduced may be had from the fact that one of the oldest boatmen reports that his expenses for two boats on his last round trip exceeded his earnings by $10.50. A few of the more shrewd and successful boatmen have managed to make both ends meet, but the general testimony of the boat-owners is that the business is ruinous.

Railroads have generally succeeded in meeting each other upon some scheme of combination, but the canal has always been the lowest bidder for freight across the state of New York. If it should cease to be a competitor of the railroads there would be a speedy rise in the rate of transportation from the lakes to the Atlantic ocean.

The Western shipper can do nothing to remedy the matter unless he should have a chance to favor the building of the proposed ship canal from Buffalo to the Hudson river.

This project contemplates the enlargement of the Erie canal to sufficient proportions to admit ships, and in case it should be carried out, the vessels

now carrying product from the great lake ports of the West to Buffalo would proceed through to New York without losing time or money by transshipment of their cargoes.

There are some serious obstacles in the way of this project, but it is one of the possibilities of the future. The Western states are deeply interested in the problem of cheap transportation to the Atlantic ocean, and the time may not be far distant when something will be done in the direction of opening the way for the great ships of the lakes to pass through to New York by a shorter and more practicable route than is now offered them.

BORING IN AUSTRALIA.

AN artesian well of great capacity is stated by *Indian Engineering* to have been bored at Lissington in Australia. At a depth of 1,070 feet a vein of water was reached, when the water rose with such force as to carry upward a line of wooden poles more than 1,000 feet in extent, smashing them against the derrick head. An 18 cwt. sinker was thrown from the bottom of the well entirely out of the boring, together with gravel and stones, that fell in a shower upon the ground. The water shot out of the well to a height of 80 feet from the mouth. It is estimated that from five to six millions gallons is the daily flow, though, as yet, actual measurement has been impossible.—*Engineering Magazine.*

FROM HIGH AUTHORITY.

The *Engraver and Printer*, of Boston, devoted exclusively to the advancement of artistic effects in engraving and letter press, writes us as follows: "We wish to congratulate you on the excellence of the mechanical production of your magazine."

RELATIVE STRENGTH OF THE TEETH OF GEAR WHEELS.

THE relative strength of material is a matter which few mechanics pay any attention to, and there is, perhaps, not one millwright in ten that can tell by calculation or otherwise, the difference in the strength of the teeth in any two pairs of gear wheels of different sizes. The fact is the relative difference in strength widens so rapidly, as the pitch is slowly increased, that it is quite difficult for one not posted in the matter to keep pace with it. We will take as an illustration two spur wheels, one with two inches pitch and six inches face, and the other four inches pitch and twelve inches face. The teeth of the first would be about one inch thick and the other two inches, and the volume of material being four times greater in the large than in the small one, many would suppose that about represented the difference in the strength. The fact, however, is the larger tooth would be sixteen times stronger than the small one, provided all other things were equal. If the teeth of the small wheel were safe transmitters of the horse power, the large one would as safely transmit 160 horse power both running at the same speed. By doubling the size again the difference will be found still more appalling. If a wheel of four inches pitch and twenty-four inches face be selected, the teeth will be 256 times stronger than the one with two inches pitch and six inches face, or capable of transmitting 2560 horse power as against 10 horse power for the small wheel, notwithstanding the difference in the amount of the material is as but 1 to 16. Sixteen times more iron in the big teeth and 256 times more strength. The difference is quite startling and will amaze the average mechanic who has never given that phase of the case any consideration, but constantly goes it blind in the selection of gearing to do different kinds of work. However, that class of mechanics is usually on the safe side in that they are pretty sure to have all gear wheels heavy enough after rising above a 1¼ inch pitch grade. Below that, it is not uncommon to find the gearing too light, not so much for resisting the strain and doing the work, as to resist breakage.

In the use of light iron-toothed gearing, some allowance should be made for breaking tendency. With heavy gearing, the attention can be given to that part of it. In estimating either actual or relative strength of bevel gearing both inside and outside thickness of teeth must be measured and an average taken.

WANTS EVERY NUMBER.

"I am sorry I allowed my subscription to expire as I do not wish to miss a single number. Please send back numbers if you can."—*R. W. Mattinson, Tempa, Ariz.*

DRAWING FOR WORKMEN.—III*

HAVING now obtained a fair knowledge of squares, drawing boards and triangles, it becomes necessary to be equipped with a knowledge of the accessories required, to be properly fitted up before actual work may be commenced. Sweeps and variable curves to some extent, are absolute necessities, for drawing circular arcs of large radius, beyond the range of the ordinary compasses, thin slips of wood, termed sweeps, are usefully employed, of which one or both edges are cut to the required circle. For curves which are not circular, but variously elliptic or otherwise, "universal sweeps," made of thin wood or rubber, of variable curvature, are very servicable. The two examples (Figs. 12, 13), have been found from experience to meet almost all the requirements of ordinary drawing practice.


Fig. 12.

Whatever be the nature of the curve, some portion of the universal sweep will be found to coincide with its commencement, and it can be continued throughout its extent by applying successively such parts of the sweep as are suitable, taking care, however, that the continuity is not injured by unskillful junction. For long curves a flexible strip of wood or metal may be used with good results, but still better, when the student can afford it, is to supply himself with an *adjustable curve ruler*, which consists of a band of thin, flexible steel, ¾ of an inch wide; this is attached to a bar of soft lead, which is covered by a long spiral spring.

The rule is bent to the required position, and the soft lead bar prevents any springing back, so that the curve or curves may be retained for any length of time. These cost from $2 to $4 each. There are a number of other devices that may be used for drawing large circles, but I think it unnecessary to describe as the student will have no trouble, I fancy, on this score.

The next step will be to consider the instruments of measurement or scales, and the student will do well by thoroughly mastering the use and

*By Fred T. Hodgson, author of "The Steel Square and Its Uses," through the courtesy of *The Operative Builder* of New York.

application of these instruments as they form the very foundation of mechanical drawing.

Scales are measures and sub-divisions of measures laid down with such accuracy that any drawing constructed by them shall be in exact proportion in all its details. The plain scale is a series of measures laid down on the face of one flat ruler, and is thus distinguished from the sector, or double scales, in which two similarly-divided rulers move on a joint, and open to a greater or less angle. In the construction of scales, subdivision may be carried to as low a denomination as may be required. Thus, for a drawing of limited extent, the primary divisions may be feet and the subdivisions inches; but for one of large area, and without small details, the primaries may be 10 feet, or even 12 feet, and the subdivision tenths or twelfths. On the triangular scale, Fig. 14, or architect's rule, as it is sometimes called, there are six scales in which the inch, foot, yard, or mile is divided into 32, 24, 16, 12, 8, 6, 4, 3, 2 and 1 parts. Each of these parts may represent an inch, a foot, a yard, a mile, or any given length that may be determined. It may be here remarked that the small measurements on any of these scales are of only limited use, and the draughtsman should lay down a scale with special reference to the work before him; and in all cases it is desirable to have the scale of construction on the margin of the drawing itself, since the paper contracts and expands with every atmospheric change. More minute subdivisions are frequently required for the draughtsman's use than those mentioned above; these are obtained by the use of the diagonal scale, which consists of a number of primary divisions, one of which is divided into tenths, and subdivided into hundredths by diagonal lines, as shown in Fig. 15. This scale is constructed in the following manner: Eleven parallel lines are ruled, inclosing ten equal spaces; the length is set off into ten equal primary divisions, as A B, B C, C 2 etc., and diagonal lines are then drawn from the subdivisions between A and B, to those between D and E, as shown in the diagram. Hence it is evident that at every parallel we get an additional tenth of the subdivisions, or a hundredth of the primaries, and

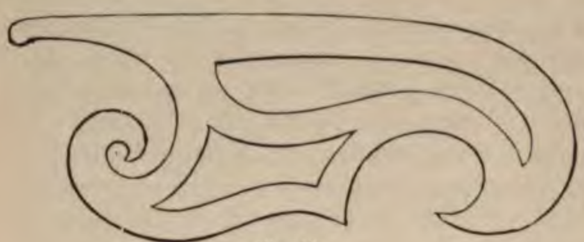


Fig. 13.

Fig. 14.

can therefore obtain a measure with great exactness to three places of figures. To take a measurement of 168, we place one foot of the compasses on the primary 1, Fig. 16, and carry it down to the eighth parallel, and then extend the other foot to the intersection of the diagonal, which falls from the subdivision 6, with the parallel that measures the eight-hundredth part.

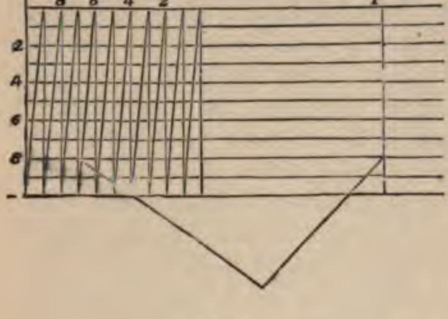


FIG. 16.

More examples or further explanation would only be tedious. The primaries may of course be considered as yards, feet, or inches, and the subdivision as tenths and hundredths of these respective denominations.

The diagonals may safely be applied to a scale where only one subdivision is required. Thus, if seven lines be ruled, including six equal spaces as Fig. 17, and the length be divided into primaries, as A B, B C, etc., the first primary, A B, may be subdivided into twelfths, by two diagonals running from 6, the middle of A B, to 12 and 0. We have here a very convenient scale of feet and inches. From C to 6 is 1 foot 6 inches; and from C, on the several parallels, to the various intersections of the diagonals, we obtain 1 foot and any number of inches from 1 to 12. All of which is evident from the figure.

FIG. 15.

On the face of the plain scale that carries the diagonal one, there is usually a line of inches and tenths, and underneath it a decimal scale. These can be used separately, and in conjunction; and in the latter case the primaries of the decimal scale being taken as feet, the subdivisions of the upper line are inches.

FIG. 17.

The line of chords is usually introduced on the plain scale. It is an unequally divided scale, giving the length of the cord of an arc, from 1° to 90°. The quadrant, or quarter of a circle, A C, Fig. 18, contained between the two radii at right angles, B A and B C, has its extremities joined by the line A C, to which the measures of the chords are to be trans-

ferred. The quadrant is divided into nine equal parts then from C, as a center, each division is transferred by an arc to the line A C, and the chords of every 10° obtained. These primary divisions can be subdivided into tenths, of 1° each, by division of the corresponding arcs. This is rather an illustration of the construction than a true method of performing it. A line of chords can be laid down accurately only from the tabular sines, delicately set off by the beam compasses. In using this scale, it is to be remembered that the chord of 60° is equal to radius. Therefore, to lay down an angle of any number of degrees, draw an indefinite straight line; take in the compass the chord of 60°, and from one termination of the line, as a center, describe an arc of sufficient extent; then take from the scale of the chord of the required angle, and set it off on the arc; lastly, draw another line from the center cutting the arc in the measure of the chord. To ascertain the degrees of an angle, extend the angular lines, if necessary, that they may be at least equal to the chord of 60°; with this chord in the compasses describe an arc from the angular point; then take the extent of the arc and apply it to the scale, which will show the number of degrees contained in the angle.

FIG. 18

There is a "Line of Chords" marked on the center, which I will describe in the next chapter in connection with a description of the instrument. Generally, there is in a box of instruments, an ivory scale on which are a number of lines and scales, also a protractor for setting off and measuring angles. The most eligible form for this instrument is the circle or half circle, which construction will presently come before us. It will suffice for the present to say, that the plain scale protractor is a portion of a semicircle, having radii drawn from its center to every degree of its circumference. If, therefore, the center on the lower side is made to coincide with a given point, an angle of any number of degrees may be measured or set off around its edges. This protractor, or scale, with the angles marked upon it, may be used efficiently in many instances, but the semicircle, shown at Fig. 19, though different in form, is the same in principle, does its work much more readily and equally as well. It is a half circle of brass or other metal, having a double graduation on its circular edge. The degrees run

FIG. 19.

both ways to 180, so that any angle, from 1 to 90° may be set off on either side. Each graduation marks an angle and its supplement; thus, 10, 20, 30 coincide with 170, 160, 150, and are the supplements of each other. An angle is protracted or measured by this instrument with great facility. To protract an angle, draw a line and lay the straight-edge of the protractor upon it, with its center on the point where the angle is to be formed; the required number of degrees is next marked off close to the circular-edge; the instrument is then laid aside, and a line drawn from the angular point to the one which measures the extent of the angle. Thus, in the figure, B is the center, or angular point, D the measure of the angle, and B D the line by which it is formed. The converse operation of measuring an angle is equally simple; the angular point and the center of the protractor are made to coincide, and the straight-edge of the instrument is laid exactly upon one line of the angle, when the other will intersect the circular-edge, and indicate the number of degrees. The plain scale protractor is used in the same manner; but it is by no means so convenient an instrument as the semicircle. Either of them may be employed occasionally to raise short perpendiculars. For this purpose, make the center and the graduation of 90° coincide with the line upon which the perpendicular is to be raised.

Each of these scales we have described has a fixed measure that cannot be varied; but we come now to speak of those double scales in which we can assume a measure at convenience, and subdivide lines of ***any*** length, measure chords and angles to ***any*** radius, etc.

(TO BE CONTINUED.)

A CITY PAVED WITH MARBLE.

A CITY paved with marble! It sounds strangely enough, yet in the heart of poverty-stricken Ireland there is just such a city. Kilkenny, one of the Irish parliamentary boroughs, is not only paved with the costly stone, but many of its houses are built with the same material. Half a mile outside the town are the famous black marble quarries, which turn out the choicest marble in the British Isles. From time immemorial the civic authorities have been accustomed to buy this stone, undressed, to pave and build with. The old Norman walls of Kilkenny were of marble throughout, as is the cathedral of St. Carnice, to-day. Kilkenny has two other peculiarities. Its water is wonderfully clear and pure, while the coal used in the city, coming as it does from the Sliere Marge anthracite region, emits no perceptible smoke.—*Dublin Independent.*

BUILDING STONES OF TEXAS.

THE variety and widespread occurrence of the rocks of Texas suitable for construction is so great that it will be impracticable to allude to them in any other than general terms. They will therefore be grouped under general headings.

GRANITES.

Granites occur in widely separated portions of the state. The first locality is what has been termed the Central Mineral Region, the second is in the extreme west, or Trans-Pecos Texas. The granites of the first or central region are of different colors. The best known is the red granite, such as was used in the construction of the capitol building. The color is red to dark reddish-gray, varying from fine to rather coarse grain in structure, and susceptible of high polish. The outcrop of the granite, which can be quarried to any desired dimensions, covers an area of over one hundred square miles.

There is a quarry now in operation on the portion from which the granite was taken for the building of the capitol, on account of which it was originally opened, the material used having been donated by the owners, Col. Norton, Dr. Westfall, and Geo. W. Lacy.

Beside this particular granite there are many others in this region which will prove as useful. In the northern part of Gillespie county there is a brownish granite of very fine grain which takes a beautiful polish; and in addition there are found in various portions of the region, granites varying in color from light to dark gray which are well adapted for building purposes, and in some instances will prove of decided value for ornamental and monumental purposes.

The granites of Trans-Pecos Texas, like those of the Central Mineral Region, are well suited both for building and ornamental purposes. The western granites, however, lack the variety of color which is found in those of the central region, being for the most part a lighter or darker gray, the feldspar being very light colored in all of them. They are adjacent to railway transportation, however, as the Southern Pacific railway passes very near their outcrop in the Quitman mountains and directly by them in the Franklin mountains, near El Paso, and will sooner or later come into market.

PORPHYRIES.

Among the most beautiful and indestructible of our building stones we must place the porphyries. Their hardness, however, and the difficulty of

quarrying and dressing them, often prevent their taking the place in actual use that their good qualities would otherwise secure for them, but where the elements of durability and beauty are sought their worth must be properly recognized.

Porphyries of almost every shade and color abound in Trans-Pecos Texas. There are in the museum specimens taken from the outcrops in the Quitman mountains alone which are readily divisible into twenty or more shades. These vary through light grays, yellows, reds, purples, and greens to black, and their polished surfaces are especially rich. The quantity and accessibility to railroad transportation must prove sufficient inducement for their development.

MARBLES.

The deposits of the marbles, like those of the granites, are found both in the Central Mineral Region and in Trans-Pecos Texas. In addition to these deposits, there occur in numerous places limestones more or less altered from various causes which are locally called marbles, and are sometimes both beautiful and useful when properly dressed. Among such deposits may be noticed what is known as the Austrian marble, a stratum of the Cretaceous which has been altered until its fossils have been changed to calcite. The body of the stone is when polished of a light yellow color, and the tracings of the contained shells is pure calcite, which gives a very pretty effect, although their fragile character detracts greatly from the usefulness of the stone. Other deposits of similar semi-marbles of various colors are found among the Carboniferous limestones of the northern portion of the state. The marbles and semi-marbles of the Central Mineral Region are the altered limestones of the Silurian and older beds, some of which are of fine texture and capable of receiving an excellent polish. The marbles of the Silurian beds found in San Saba, Burnet, Gillespie and other counties, which are known as "Burnet Marbles," are both of solid color and variegated. They are found in beautiful pink, white, buff, blue, and gray shades, and although not true marbles, are well adapted for many uses.

The marbles belonging to what are called the "Texan Beds," a formation older than the Silurian, are, however, real marbles. They are found near Packsaddle mountain, Enchanted peak, and in the Comanche creek region of Mason county. They are often snowy white in color, of even grain, and among the deposits are found strata of medium thickness. They are not, however, as extensive as the deposits of the semi-marbles.

In Trans-Pecos Texas marbles belonging, as is supposed, to the same geologic age, exist in great abundance, and for beauty of color cannot be surpassed.

From the Carrizos to the Quitman mountains outcrops occur in the

vicinity of the railroad of marbles which are certain at no distant day to become the basis for great commercial industry. They are found banded or striped and clouded as well as pure white. They are fine grained, and can be quarried in stone of almost any dimensions. Some of them when polished will rival the Aragonite or Mexican onyx in delicacy of coloring.

LIMESTONES.

The limestones of Texas which are suited for building purposes are abundant and widespread in their occurrence. The Cretaceous formation which covers fully one-fourth of the entire area of the state abounds in limestone well adapted for structural purposes. In addition to this we have the limestones of the Carboniferous, Permian, and Silurian system, so that the total area is largely increased.

The limestones of the Cretaceous occur both in its upper and lower divisions. In the Austin chalk there are beds which furnish excellent stone which is quarried for use in many places, but a large portion of it is too chalky and not firm enough for general use. The best limestone of this formation is that contained in the Fredericksburg and Washita divisions of the Lower Cretaceous.

These limestones are of color varying from white to yellow, very rarely darker, and are often somewhat soft when first quarried, becoming harder on exposure.

Among the materials of the Clear Fork division of the Permian formation are some even bedded limestones of square fracture, fine even grain, and good color, that will prove valuable as building material. These were observed in the northwestern part of Shackelford county, and will also be found north and south of that locality along the outcrop of these beds. Seymour and Ballinger show buildings constructed of these limestones.

SANDSTONES AND QUARTZITES.

The sandstones are fully as widely distributed as the limestones, being found in nearly all districts in greater or less quantity.

In the Fayette sands are found beds of indurated sands of light color which have been used in various localities along their line of outcrop for building purposes. Rock has been quarried from these deposits from many localities, principally at Rockland, Tyler county; Quarry Station, on the Gulf, Colorado, and Santa Fe Railroad; Rock Quarry, on the Houston and Texas Central Railway, in Washington county, and in various parts of Fayette, Lavaca, and other counties to the southwest.

In the Timber Belt Beds the altered (and even the unaltered) greensand marls are sometimes so indurated as to be used for building purposes. In addition to which many of the hill-cappings of sandstone, which at times replace the iron ore, are valuable building stones. In the Cretaceous area

north of the Colorado river there are no sandstones of any particular value so far as our examinations have extended.

The area of the Central Coal Field abounds in excellent sandstone for building stone, some of which has been extensively quarried and used in the construction of buildings from Dallas west to Cisco. It is of good color, quarries well, and presents a handsome appearance in the wall. It is so generally found in this district that it is impossible to name the localities.

In the Permian there are sandstones which will be of wide application in the buildings of the state. East of Pecos City, at Quito, on the Texas and Pacific railway, a company has recently opened a quarry in a compact, well-jointed red sandstone which is probably of Permian age. It is of a beautiful red color, uniform in texture and color, easily worked yet durable, and in every way adapted to the best uses in building. The company in boring a well at the place have passed through more than one hundred feet of this red sandstone, thus proving its unlimited quantity. It will compare favorably in every way with the sandstones formerly imported into the state for the fronts and trimmings of buildings.

Beyond the Carrizo and Diabolo Mountains there is a fine grained red sandstone which is destined to be one of the finest building stones of the state. It is a little darker in color than the Quito stone, finer grained, firmer, of even texture, and will lend itself to almost any character of decoration.

In this Trans-Pecos Region there are many other sandstones and quartzites which will in time come into use for structural purposes.

SLATE.

The two areas in which the older rocks are found both give promise of furnishing slate suitable for roofing. In the Central Mineral District several localities have been examined which on the surface give indication of furnishing good roofing slate, and in the vicinity of the Carrizo Mountains, El Paso county, similar indications are found.

It will of course require some actual work in opening the quarry sufficiently to ascertain the condition of the material below the surface to fully decide the value of the deposits, but the indications are very favorable and warrant such an attempt at development.

Thus it is readily apparent that in building stone there is no lack of variety, as well as an ample supply of all that can be made useful.

LIME.

As is well known, the lime made from the rocks of that horizon of the Cretaceous formation known as the Caprina Limestones (which is the most persistent bed of all the formation) is unsurpassed for quality. The fame of the Austin lime is well established. Other beds of the Cretaceous will answer well in lime making, although some of them contain too much clayey

matter, or are otherwise unfitted for this use. Lime is also made from the limestone of the other deposits, but none of these have been so successfully operated as those above mentioned. The reports received for 1889 gave a total production of 190,000 barrels.

CEMENT MATERIALS.

Cements are of two kinds, natural, or hydraulic, and artificial, or Portland.

Natural, or hydraulic, cement is made from certain clayey limestones, which, when burned and ground, have the property of setting or becoming hard under water. Portland cements are of similar character, but are made by artificially mixing the limestone and clays in the proper proportion.

Materials for both characters of cement exist in abundance within the state. The limestones of certain beds of the Cretaceous are argillaceous enough to make cement when properly calcined and ground, and the same properties are claimed for some of those found in the Tertiary, but our tests have so far failed to bear out the claim. Some of the limestones belonging to the Clear fork beds of the Permian might answer if the percentage of magnesia was not too great.

The materials for Portland cement are, however, more abundant, and the product of so much better quality as to render the natural cement a matter of comparatively small importance. The Austin chalk is rather widespread in its distribution and adjacent to clays of almost any required grade.

The entire practicability of the manufacture of Portland cement has been shown by the two factories which have undertaken it, one at San Antonio, the other at Austin. The former supplied much of the cement used in the erection of the present capitol building, and as the reports of it by Gen. Gilmore show, it was of very excellent quality.

The works at Austin are now underway, and it is proposed to increase their capacity.

E. T. Dumble.

"STONE IS PLEASING."

"I am highly pleased with the late improvements in STONE. Its publishers deserve success."—*Chas. Neidhart, Beatrice, Neb.*

"You deserve encouragement for presenting such an interesting monthly." —*Chas. A. Pfeiffer, St. Joseph, Mo.*

SOME CURIOUS MINERALS.

TRAVELERS who have visited the city of Florence, in Italy, will remember seeing in the shops thin pieces of marble framed like a picture, which are marked with an irregular design of a gray or yellow color, somewhat resembling a ruined city with its towers, roofs, and steeples. A fine specimen of this stone is illustrated in Fig. 1, which is one-quarter of the size of the original.

FIG. 1.

In an old work by Athanasius Kircher — the *Mundus Subterraneus*, published in 1678 — the author speaks of this peculiar marble, and gives a quaint engraving supposed to represent the markings on a piece of this stone in his possession. (Fig. 2.) A comparison of the two illustrations shows that Kircher was an "idealist" in art, and possessed the faculty of drawing upon the imagination to a great degree. The pictured Florentine marble, however, is curious and beautiful enough in itself without the aid of an artificial exaggeration of its characteristics, and its resemblance to an *urbs turrita* would naturally occur to every observer.

The way in which this marble was formed is simple, but very interesting. The stone, which is called by the Italians, *alberese*, is an impure marble containing a small mixture of clay, and its peculiar stratified — or, more properly, *jointed* — structure is due to the pressure of the overlying strata. It is a well-known

fact that when a plastic mass—like wax, clay, or any soft deposit of earth—is submitted to great pressure, it tends to become laminated, and cleavage planes are formed at right angles to the compressing force or forces, so that it tends to split up into thin plates or angular prisms. The common slates and shales are good examples of this action in past geological ages, and it may also sometimes be observed in a modern clay-bank, or be artificially produced in clay or wax.

FIG. 2.

Alberese, then, is a clayey limestone, which, by the pressure of the overlying rocks, has been transformed into a mass of irregularly shaped prisms. The minute fissures between these prisms would allow the entrance of water holding coloring matter in solution, which would give the stone its characteristic tint, and would also tend to cement the whole into a solid mass by the carbonate of lime dissolved in it, thus forming a stone apparently crystalline in its nature, but really owing its angular structure to simple mechanical pressure, and not to those more mysterious forces which shape the geometrical outlines of the true crystals.

FIG. 3.

One of the best-marked characteristics of most rocks is their rigidity, but a few species are known which are more flexible than wood, and bend read-

ily under slight pressure without breaking. The itacolumite, or flexible sandstone, is the most abundant of these rocks, and is found principally in Brazil, although a similar formation is met with in numerous other localities, in small quantities. The illustration (Fig. 3) shows aslab of itacolumite supported by its two ends and bending by its own weight.

The flexibility of itacolumite is readily understood when the stone is examined with the microscope. All sandstone consists of separate grains of sand transformed into solid rock by some cementing material which has percolated in solution between the grains. This cement varies in its nature, and may consist of carbonate of lime, oxide of iron, silica, or many other substances, even including, in a few rare cases, native silver and copper. All these ordinary sandstones are rigid and brittle, but in itacolumite the grains are cemented together by a mineral closely resembling mica or sericite. These minerals, being quite flexible in themselves, confer the same property upon the sandstone as a whole. In Fig. 4 is shown a microscopic view by polarized light, of a piece of this stone ground so thin that it is transparent. The separate grains of sand (silica,) each surrounded by a coating of the flexible cementing material, are very plainly indicated. The way in which the cementing material was introduced into the itacolumite is not easy of explanation. Mica and sericite are not soluble, and could not have been deposited there by water, like calcite or silica. It is most probable that they were originally in the form of clay, or some similar mineral, and afterward *metamorphosed* by heat, pressure, and superheated steam into the micaceous mineral. Instances of a similar change of one mineral species into another are very common.

FIG. 4.

Itacolumite is also remarkable for the precious minerals and metals occurring in it. Scales of gold and diamonds are abundant, and the celebrated gold and diamond-bearing sands of Brazil have been largely formed by the disintegration of this rock.

There are other sandstones which do not show any cementing material

between the grains, but appear to owe their flexibility to the actual interlacing of the rough grains of sand. These specimens, however, are not very abundant, and are entirely different from the itacolumite of Brazil. —*Popular Science News.*

A LARGE CRANK SHAFT.

IN view of the current interest in crank shafts for large engines, attention is called to a wrought-iron shaft just shipped by the Corliss Steam Engine Company, for a pair of triple expansion engines which they are furnishing for the Fall River Iron Works Company. This shaft is twenty-six feet two inches in length, twenty-two inches in diameter, and with the two-wheel centers and two-crank disks which it carries, weighs 74,640 pounds. The shaft was forged at the works of the Corliss Engine Company, at Providence, weighed in the rough 35,630 pounds, and required in forging forty-eight heats. The wheel which it is to carry is twenty-eight feet in diameter and 184 inches face, with a double set of arms, and weighs, finished, 152,000 pounds.

ROOFING SLATE IN THE SOUTH.

COL. D. L. SUBLETT, C. E., contributes to a recent issue of the *Tradesman* an article on the subject of Southern roofing slates, in which he discusses the sources of supply and the generally excellent quality of the material for roofing purposes. In the course of his remarks he says that while great interest is being manifested and many millions of capital are being invested in Southern timber, coal, iron, marble and other mineral properties, it seems strange that so little interest should have been manifested in the finest structural mineral known and so universally used as that of roofing slate. Its composition, texture and resistance to the destructive elements generally, as well as its wide range of color and susceptibility of receiving a high polish, renders it superior to any other stone for structural purposes. Its use is not confined alone to roofing, but it is used for numerous other purposes, such as flagging, school slates, slate pencils, mantels, flooring tiles, vestibule trimmings, steps, risers, laundry and bath tubs, bar and billiard tables, blackboards, counter-tops, cistern-linings, brewers' vats, grave-covers, coffin-boxes, monuments, etc. In fact, it finds new applications yearly, and its demand is constantly on the increase, especially in the South and Southwest.

With regard to the geological location of the slate deposits, the writer states that the slate belt in the Southern states, so far as known, may be said to extend from near Lynchburg, Va., in a general southwest course, crossing the line of Tennessee and Virginia some 15 or 20 miles east of Bristol, and continuing in a southwest course near the line of Tennessee and North Carolina through Polk county, Tenn., entering Georgia in Murray and Pickens counties, and then in the same general course through Gilmore, Gordon, Bartow and Polk counties, passing into Alabama, and termining near Calera, in the latter state. Its geological position is near the line of contact between the lower silurian and metamorphic groups.

It will be seen from this that a greater part of its course is inaccessible by reason of the ruggedness of the country through which it passes, and in this section some of the slates are generally hard and unsuitable for roofing purposes, and this is especially the case with most of the Tennessee slates. On entering Georgia, however, the country becomes less rugged

and mountains become hills, and the slate belt is crossed by several trunk lines of railroad.

At the intersection of the East Tennessee, Virginia and Georgia and the East and West Alabama railroads is located the beautiful and thriving town of Rockmart, and at this point, and almost within a stone's throw of two depots, the slate crops out in low hills in beds of great thickness and has been quarried here in a small way for thirty years. Previous, however, to 1883–85, the slates were all hauled twenty-three miles to Cartersville, Ga., to be shipped at a good profit. The quarries are worked in the most primitive style, without any of the improved methods now in use, and only roofing slates are made, all the other product of the quarry being wasted, which, in reality with proper machinery, could be made the most profitable. There are not made here annually over 5,000 or 6,000 squares, which is sold f. o. b. cars at $5 per square, yielding a net profit, after paying 50 cents royalty, of $1.75 or $2 per square. Large contracts are frequently refused for the reason that enough squares of one particular size cannot be supplied, and the present operators are frequently three or four months behind in orders. The slates are unsurpassed in texture and color, being of a dark blue and unfading, and are at present quarried entirely above water-line.

The writer cites some remarks of Prof. N. A. Platt, in charge of the geological and mining bureau of Georgia, who, in speaking of these slates and the metamorphic changes that have occurred at Rockmart, says: "Shales have been converted into roofing slates, limestones into marbles, iron ores into ochers, black shales into plumbago, etc. This belt of marbles, slates, limestones and dolomites is at Rockmart from one to one and a half miles wide and bears about north, 60° east, and the strata dip at an angle of 40° to 50° southeast. From openings and quarries on these hills, the true slate belt is estimated to be between 800 and 1,000 yards wide. The slates are of a fine, close-grained, tough and somewhat elastic quality, and with well-defined joints and cleaveage planes, quite fissile and hence easily split into sheets of any desired thickness. It is unusually free from contamination by pyrite quartz or veins of calcite. They remind me very much of the world-famous slates of Penrhyn, Wales, to which I consider them equal in every respect. They stand to a remarkable degree the action of strong chemicals in the laboratory, and heat well without fracture, and hence are well adapted to the enameling process, and exposed to the weather for years show no discoloration or unsightly stains. They are without doubt of first-class quality, lie favorably for the quarryman, work kindly in the hands of the slater, are easily nail-punctured by the roofer and are quarried within a few hundred yards of two trunk lines of railroads."

THE STONES OF BAALBEK.

A WORD must be said upon one question about the Baalbek ruins which must naturally arise in everyone's mind with respect to the transport of the colossal stones. How could they possibly have been removed from the quarries to their appointed place? How raised from the ground into their present position?

By way of solution to this mystery many suggestions have been offered, but none of them can be considered entirely satisfactory. Such theories as those of inclined planes, rollers and such-like methods are well known to all. One ingenious surmiser has hazarded the opinion that elephants were common in Syria in those days, and that a score or two of these animals could have managed the business by the aid of ropes of raw cow-hides. But no theory that has yet been started is sufficient of itself to solve the difficulty; though it is, of course, not improbable that one or another of the methods suggested may have been utilized in combination with other means. About four years ago, however, a couple of Druses from the Hauran described to me a remarkable machine, which had been discovered, according to their account, at Salkhah at the southeastern base of the Jebeled-Druse, or Druse Mountain, celebrated by the Psalmist as "the Hill of Bashan." At the time I did not, unfortunately, realize the importance of the discovery which these Druses had made. But after due reflection and consultation with others, I came to the conclusion that nothing less than an original machine, for the hoisting and conveyance of enormous blocks of stone, had been brought to light, and that, if it could be produced, one could see with one's own eyes a practical example of the solution of that which has so long been a mystery.

The information which I received was necessarily vague and indefinite, for the Druses had no idea that they had made any important discovery; but from what I could make out, the principle of the machine was of a marvellously simple nature. It appears to have a gigantic lever of the first order, the fulcrum of which was supported by a huge tripodal pedestal. The tripod and the beam were each composed of a great number of bundles of rough logs of wood (probably of the silver poplar, which still abounds in the neighborhood of Damascus, and the trunks of which are straight), stout, strong and seasoned, and clamped firmly together by iron bands and rivets. It is evident that such a machine could be made strong enough for any required purpose by the simple addition of a sufficient number of these wooden logs or beams, each secured to the others by these stout iron clamps. The lever worked on a pivot on the top of the tripodal support, and was so arranged that the arms had a horizontal as well as a vertical motion. At the end of one arm of the lever was a series of strong iron claws to catch the stone; at the end of the other an enormous cage. When the stone was required to be raised from the ground, this cage was simply filled with smaller stones, until their united weight counterbalanced the weight of the

stone required to be raised. As soon as the stone was lifted the necessary height from the ground, it was pulled round horizontally, either through an angle of 180°, if it were a question of transport, or above its required position if it were a case of building. Then it would be lowered into its place by the simple expedient of removing the stones from the cage. This mechanical power was of a very primitive but ingenious character, and it answered the purpose admirably.

Of course it must be understood that the above description is in a great measure conjectural; for I never saw the machine myself, nor, so far as I know, has any European examined it. Indeed, from the Druses' account, even when discovered it must have been in a fragmentary and dilapidated condition, and even before the circumstance was reported to me at all the inhabitants had already begun to break it up for the purpose of using the beams for the roofs of their houses and availing themselves of the iron. From some travelers who have visited Salkhah this year, I learn that all traces of it have disappeared. It is possible that my theory may itself be wrong, and that after all the machine may have had nothing to do with the raising and conveyance of stones; but several mechanical engineers to whom I have mentioned the subject consider it not only possible but highly probable that it was by means of such an appliance as this that the difficulty presented even by the Cyclopean stones of Baalbek may have been surmounted.—*Macmillan's Magazine.*

PROF. WINCHELL ON MINNESOTA STONE.

"THE use of stone for construction in Minnesota has but fairly begun. This is owing to the lateness of the settlement of the country by Europeans, and the ease with which other material has been obtained. Pine lumber and brick are both abundant and cheap. From the log house of the pioneer to the elegant stone mansion of his successor of to-day there is necessarily a slow change in most of the western country, but in many parts of Minnesota this change has been so rapid that a single generation has witnessed both. All builders and architects of the state ought to have regard for the products of our quarries, and to avoid the importation of foreign stone when suitable material can be found within the limits of the state. There seems to be no reason for thinking that Minnesota is deficient in stone suitable for all kinds and styles of architecture. The stone found in Dresbach, Winona county, is so nearly like sandstone imported from Ohio that it can be used in the same building; and there are very many other deposits of valuable building and ornamental stones all about the state."

THE PASSING OF TENNYSON.

THUS sails he forth, into the broader light.
"No moaning of the bar,"
No battered hulk upon a storm-tossed sea
Nor sailing in the dark,
Nor beating 'gainst the wind upon a wild lee
shore;
But all full-sailed, with compass, chart and quadrant true,
He sees his Beacon right ahead
And from the golden haze of light
Heaven's portals burst to view.

Thus sails he forth, unto the greater hope,
"No moaning of the bar" for him,
No heaving of the lead in fear
Nor rocks nor shallows in his course;
But all full-sailed at eventide,
His helm safe in his Pilot's hand
He trusts his Captain with his bark
And leaves life's ocean in his wake,
And anchors off his Father's land.

George Beaumont Benford, Hydeville, Vt.

TECHNICAL VALUE AND PREPARATION OF MAGNESIA.

MAGNESIA, formerly chiefly valued on account of its medicinal properties, has recently risen into great commercial importance, owing to its infusibility and its employment as a lining for converters used in the basic process of steel manufacture. Caron, whose process was in the first instance followed, used calcined magnesite. This was made up with one-sixth of its weight of tender-burned magnesia, and from 10 to 15 per cent. of water, into a plastic state; it was then compressed into bricks in iron moulds, and burned at a dull red heat. Prof. Ehrenworth has pointed out that, if the refractory properties of the magnesia are to be evoked to the full, it is of the utmost importance that the whole of the magnesia should be dead-burned; the process, moreover, being carried so far as not only to expel the whole of the carbonic acid, but also to cause the full amount of shrinkage which this material is capable of attaining. This extreme

amount of calcination is very difficult to effect, owing to the tendency of the magnesite to fly into splinters, and to drop to pieces when subsequently touched, and in consequence of its being such a bad conductor of heat the stone is very hard to burn in large pieces.

Recently dolomite, which is a double carbonate of lime and magnesia, has been used instead of magnesite. In order to prepare this material there are two processes before the public; that of Closson and that of Scheibler. Under the former plan, the calcined dolomite is mixed with chloride of magnesium, the chlorine in which separates from the magnesia and combines with the lime, yielding a soluble calcic chloride which can readily be washed out, leaving behind the insoluble magnesia. Under the process of Scheibler, the calcined dolomite is treated with dissolved sugar, leading to the formation ot sugar of lime, and depositing the magnesia. The solution of sugar of lime is then exposed to carbonic acid gas, which separates the lime as a carbonate, leaving the sugar ready for re-use. Both these systems of producing magnesia have the advantage of relative cheapness in their favor, owing to the low price of dolomite. Prof. Frank, of Charlottenburg, has advocated the use of magnesia as a substitute for plaster of Paris for casts, and Grundmann has recently shown the advantage of employing a mixture of magnesia and powdered marble for this purpose. The author states that he has found, following the direction given by Hirzel, that a mixture of benzole and magnesia is the very best possible substance for the removal of grease from drawings or from any other material.—*Annalen fur Gewerbe und Bauwesen.*

A CURIOUS RELIC.

IN the collection of antiquities and oddities in the rooms of the State Historical Society at Concord, N. H., is a stone head, the origin of which it is impossible to trace. A gentleman plowed it out of his garden and nothing like it is now known to exist anywhere in the world. From the top of the forehead to the bottom of the chin is about four inches, from the tip of the nose to the back of the head, three inches. The head is represented as long and narrow, with what would be called a Roman nose, totally unlike anything ever found in the way of primitive sculpture anywhere in New Hampshire, where Indian relics are very numerous. Many have speculated upon its origin and don't know whether to refer it to a race of people who inhabited the land before the Indians, or whether it is an accidental carving wrought by some Indian sculptor as a purely imaginative piece of work. With this may possibly be placed some of the bits of stone found in the foot-hills about the White mountains with tracery

upon one or both sides, forming characters unintelligible to students of either geology or philology. The evidence is too limited and the discoveries so far of a character which do not admit of systematic study.

THE LARGEST CORINTHIAN CAP IN THE UNITED STATES.

ON Libby Hill, Richmond, Va., is a Confederate soldiers' monument which has the largest Corinthian capital in the United States. It is of granite, 8—8×8—8×7—10½ and weighs 85,000 pounds. The monument is a facsimile in design of Pompey's pillar and is built of very large blocks of granite. There are five blocks in the lower course which averaged from 20 to 30 tons, and the twelve stones in the shaft average 15 tons each. The granite was quarried and cut by the Petersburg Granite Quarrying Company, Petersburg, Va.

EDITORIAL COMMENT.

THE great strike among the granite workers of New England is approaching a settlement. At Quincy, Mass., Barre, Vt., and many smaller centers an agreement has been reached which is satisfactory to both employers and employes. This battle between organized capital, represented by the New England Manufacturers' Association, and organized labor, in the National Granite Cutters' Union, has been the hardest fought and longest of any labor difficulty on record. For twenty-one weeks the contest has been going on, and meeting after meeting between committees from both sides ended without result. Each side insisted upon maintaining its original stand and for a long time no concessions of any kind were made. But such action seemed like suicide on both sides, and concessions began to be agreed to, which finally resulted in a compromise settlement, on which neither side can claim a distinctive victory.

AS WILL be remembered the trouble began over the bill of prices which terminated May 14. The employers wanted the new bill to date from January 1, the same as a larger proportion of bills in the West have dated for some time. The men would not accept January 1 as a date, insisting upon May 1 as the earliest they would accept under any condition. So the matter hung, neither side yielding until, at last a compromise date, March 1, has been agreed upon, both sides making concessions and meeting half way upon common ground. The new bill runs until March 1895, with proviso for arbitrating any dispute and an agreement to give at least three months' notice prior to the date of termination if any changes are wanted by either side. It is also agreed that there shall be no lockout or strike, pending arbitration of difficulties which may arise. Should no notice be given prior to the termination of the bill it remains in force for three years succeeding March, 1895.

COMMON ground seems to have been reached at last, and one of the most costly strikes the country has ever experienced is ended. Hundreds of thousands of dollars will not cover the loss sustained by those connected with the granite business, and allied trades, to say nothing of the loss to other business influenced more or less by the granite industry; ranging from the great railroad corporations, carrying their thousands of tons of freight, to the humblest groceryman in the country villages where one quarry is operated. Everybody has felt its injurious effects; everybody has sustained losses of greater or less magnitude.

TO GO a step farther, the sufferings and privations of the women and chil-

dren, composing the families of the strikers, can never be computed. True, the strike pay came regularly; but where the regular pay of from fifteen to twenty-five dollars per week, scarcely sufficed for a living, how have they lived on six dollars doled out by the finance committees of the unions? The savings have been used up, large bills have been run at the groceries and self-denial of the most exacting sort has been required to exist at all. But the future looks brighter. The men are at work. All difficulties are settled for the present and it is certain that there will be no more trouble of any magnitude until the demand for the eight hour day with ten hours' pay is made. That may come in 1895; it may come in 1898. But it will come sooner or later.

Now what are the points gained by this prolonged contest? First and foremost an added respect on the part of each organization for the other. It has been proved that the resources and ability of both organizations to carry on an endless conflict are limitless. The manufacturers gain a point by securing a concession which allows no discrimination between union and non-union men, and the men gain a point in the agreement of the manufacturers to recognize the fifty or more firms which have been formed since the trouble began. That is all, and it looks like a small return for the loss sustained.

BEFORE the news of the settlement of the troubles in the granite centers had hardly reached the ends of the country, came the announcement that there was more trouble at Barre over the question of the employment of apprentice tool sharpeners in the place of the regular journeymen sharpeners. Men left the sheds, one manufacturer losing ten in one day. At last accounts the troubles had not been settled, and evidences of a strike to last all winter were numerous.

THE granite cutters claim the right to leave a shed when they desire as individual workmen. They present this as a rebuttal of the charge made by the manufacturers that the union cutters have violated the agreement recently made at Barre, Vt. If the individual union cutter may quit his employment when he pleases, wherein is the union justified in "scabbing" the individual cutter who may engage to work when and for whom he pleases, and tying up the business of the employer who engages him? Does the rule of right and personal liberty only operate one way?

IMITATION seems to be the besetting sin of builders. The great aim now is to erect pretentious structures, which shall compare in outward appearance with the better class of buildings, and at the same time, be put up at the minimum of cheapness. This point is well illustrated in Indianapolis in the construction of the new building to replace the old death-trap used for a medical and surgical institute, destroyed by fire with such appalling loss of life. The new institute building will be more substantial than the old one, but cheapness is the object aimed at, while the desire to imitate the outer appearance of a noble building is strong. To carry out this design rock-faced brick are being used in construction. These brick are made in imitation of sandstone which is so often used in public buildings. No argument in favor of the use of such material can be advanced excepting that of cheapness, and to secure that end, durability and solidity are sacrificed, and buildings erected adorned with the most ornate ornamentation to cover

up defects in material or construction. Those who have the erection of this institute building in charge are no more offenders than hundreds of others. It is a spirit which has seized the people and until the incubus can be shaken off there will be more or less of cheap, unstable buildings. It were better that the buildings in all such cases be made smaller so that the genuine stone could be used in construction and at the same time keep within the limit of cost. If rock-faced building stone is to be imitated, it is surely a strong argument in favor of the use of genuine stone in the erection of buildings. Only good things are imitated, and "imitation is the sincerest flattery." It would be well for those contemplating the erection of any building to stop and consider carefully before accepting rock-faced brick in the place of stone, merely because it costs a few dollars less.

THE foregoing may be regarded as representative of the direction toward which we are drifting. Art in all ages has been illustrative of the strongest passions of the people producing it. That being true, the style of architecture adopted by us at present represents the dominance of commercialism, the mammon of this latter part of the nineteenth century. Mammon says a certain amount of rent must be secured from a certain plot of ground. Straightway springs up a twenty-story building, having no more claim to be considered artistic than the hut of the Esquimaux, built of blocks of ice amid the snows of the north. The motif is bad to begin with. We find all the meaningless mouldings and ornaments of the colonial style adopted and used in buildings erected by people of means and ability to do better; but those people do not realize that the colonial architecture is but an imitation of European architecture when at about the lowest ebb it ever reached—the Georgian period in England. This leads to the small, insignificant mouldings and trimmings which might do for decorations for a child's play-house, but are ridiculous when used in the construction of buildings which ought to be monuments to the builders, and representative of an art which ennobles by association. The same pettiness, the same childishness is exhibited in the arrangement of bricks and other constructive materials, the whole but imitations of the infancy of the Romanesque, where, before its maturer development such ornateness had a place. The entablature of the Renaissance has been done away with and one part of the building fades into the other division excepting the difference in color of material or paint sometimes used.

THE artistic sense of the architect rebels at this prostitution of art to commercialism; but what is he to do? Nothing but build as directed, getting the best results possible from the hetereogenous mixture of styles which pass for architectural beauty in these times. He does this, hoping that the artistic sense of the people will yet be aroused and a demand for a purer, nobler architecture follow. Until then the distortions called by various names must continue to offend the artistic sense of every true lover of architectural beauty in design and treatment.

LEGAL NEWS AND NOTES.

Prepared for STONE, by V. H. Lockwood, Indianapolis.

IMPLIED WARRANTEES IN THE SALE OF GOODS. —Where there is an express warranty of quality, quantity or title, there can be no implied warranty of the same general nature. In case there is no express warranty of quality, the buyer takes the risk upon himself. He must look out unless he is indemnified by an implied warranty.

There is an implied warranty in the sale of goods by sample or description, and when they are sold for some special and known purpose.

(1) GOODS SOLD BY SAMPLE OR BY DESCRIPTION.—There is an implied warranty that goods sold by sample or by description will agree in nature and quality with the sample or description. If they agree, the buyer cannot complain, however faulty they may be.

(2) Goods are in certain sales warranted to be fit for the *purpose* for which they are purchased, where the seller knows that purpose.

But no such warranty exists where the buyer has seen the thing and understands all about it. It can exist only when the buyer cannot see it or if he has not seen it knows but little about and relies upon the superior knowledge of the seller.

(*a*) *Provisions* that are sold to consumer to be eaten must be fit for that purpose. If they are unfit because of decay or other cause the seller must refund the cost and is liable for any other damage that they cause. If the buyer, however, had seen the thing and the defects were plain to him or known to him, no such warranty exists.

(*b*) Goods of any kind that are sold to a trader for the purpose of being resold must be salable. If they are not salable, unless the buyer knew their condition at time of purchase, the seller must take them back and refund the price paid. The seller in such case is liable for secret defects.

(*c*) Machines and other goods are often sold to accomplish some special purpose. In such cases, unless the buyer has seen the machine after it was completed, has as much knowledge of the object to be accomplished as the seller and knew all about the structure of the thing, the seller warrants that the machine or thing will accomplish the purpose for which it was sold.

This renders all manufacturers liable to their buyers if the article sold is unfit for the purpose for which it was sold.

The seller of a watch warrants that it will run and keep good time, or of a brick machine that it will make good bricks.

These implied warrantees exist only for a reasonable time after the sale. What is a reasonable time is different in each case, it depending solely upon the nature and circumstances of each case. It depends upon the nature of the article, the purpose for which it was bought, and the treatment of the article by the buyer. Provisions may soon become defective from their nature or the climate or season. Machine may be good for ten years if it receives ordinary care, or it may last but one, if badly treated.

In all these cases, if the defect is due to lack of care on the part of the buyer, or his agents, he cannot lay the blame on the seller.

EFFECT OF CALLS FOR PAYMENTS ON STOCK. —Each call for unpaid subscriptions to the stock of a corporation, gives rise to a separate cause of action from the time of default thereunder, and a refusal to pay a draft for the first call cannot be considered as a denial of liability under all future calls, so as to set the statute of limitations running as against them. And so in an action to recover an assessment on the stock of a corporation, a decision that the cause of action was barred by limitation is no bar to a subsequent action between the same parties to recover a subsequent assessment. Dorsheimer v. Glenn and Priest v Glenn. U. S. Circuit Court of Appeals. 51 Feb. Rep. 405.

PROOF OF NEGLIGENCE BY CIRCUMSTANTIAL EVIDENCE.—To sustain an action for damages for death, as caused by negligence, the essential facts of negligence on the part of the company, and of freedom from negligence of the deceased, may be proved by showing circumstances from which the existence of those facts may fairly and logically be inferred. If

the inferences from the circumstances shown are not certain and incontrovertible the question is one for the jury. Potter v. N. Y. C. & H. R. R. R. Co. Superior Court of New York City 19 N. Y. Sup. 862.

WHEN STOCKHOLDERS ARE LIABLE.—A judgment creditor who has had an execution returned unsatisfied against a corporation may maintain an action against its stockholders to recover, for the benefit of all creditors who may desire to be made parties, the amount due upon unpaid subscriptions for stock. The liability of the stockholders is several, and it is not necessary to make them all parties. Proof that a creditor has lost his legal remedy against the corporation is shown by the judgment and an execution thereon returned unsatisfied. Evidence that the company owns a large amount of personal property besides its road and franchise is inadmissible. The judgment is conclusive against the company and stockholders and they cannot show that the indebtedness for which the judgment was recovered arose upon a contract which was ultra viros. One to whom stock is issued and in whose name it appears on the books of the corporation, is liable to the creditors of the corporation for the unpaid subscriptions, although he is not the owner of such stock. Baines v. Babcock. Supreme court of Cal. 30 Pac. Rep. 776.

RIGHT IN LAND PURCHASED BY ONE PERSON AT THE CHARGE OF ANOTHER.—Where a part of the price of the land is paid, and the balance is secured to be paid, by one person and the conveyance is made to another a trust results in favor of the person making such payment. Such a case comes within the exception of the old English statute, re-enacted by most of the states, providing that "No trust concerning lands except such as may arise or result by implication of law, shall be created or declared unless by an instrument in writing, signed by the party creating or declaring the same, or by his attorney." So, under this exception if only a part of the purchase money is paid by the third party there will be a resulting trust in his favor for the proportion paid. It is also well settled that though it is expressed in the deed that the consideration was paid by the grantee, yet verbal evidence is admissible to show that the consideration was in fact paid by a third person, for the purpose of establishing a resulting trust in favor of such a third person. Williams v. Wager. Supreme court of Vermont, 24 AT. Rep. 765.

RIGHT TO TAKE FORCIBLE POSSESSION ON EXPIRATION OF LEASE.—A tenant after the expiration of his term, becomes a trespasser through his holding is in good faith under a color and reasonable claim of right; and the landlord without legal process may forcibly enter, therefore, and eject him. The only question in so far as the tenancy in question is concerned is whether or not it has been terminated. If it has, the tenant is a mere trespasser and the landlord has the right to use as much force as is reasonably necessary to expel him. If the tenancy has not been terminated, he is not a trespasser and the landlord has no right to interfere with him. But the question as to whether the tenant is entitled to possession is a mere question of right, depending upon the fact as to whether the tenancy has been legally terminated, and not upon the belief of the tenant as to his right to remain. That is to say, the mere fact that a person honestly believes that he is lawfully in possession of a tenement or lands, does not prevent him from being a trespasser, and liable to be dealt with as such. Possession of real estate is either rightful or wrongful. And the right to the possession thereof is the right of ownership, is to be determined solely by the evidence submitted, and the law applicable thereto, and is not dependent upon, or in any way affected by, the belief of the claimant as to such right. If this were not so it would be in the power of any one in the wrongful possession of real estate, who believes his possession to be rightful, to compel the person who is entitled to the possession thereof to resort to an action at law to recover the same: thus practically nullifying the right which the law confers upon the owner to take forcible possession by expelling the trespasser. Allen v. Koily. Supreme Court of Rhode Island. 24 At. Rep. 776.

NOTES FROM THE QUARRIES.

Forest Port, Oneida Co., N. Y., has a bed of granite, unique and valuable. It was discovered last spring, while the New York Central railroad was building its branch to the Adirondacks. The stone has been used for the abutments and piers for all its bridges along the new line. The color is a peculiar black and gray, polishes well, ard seems to be specially adapted for monumental work. The quarry is on land owned by William Stanbury and promises to be a source of vast revenue to him, being the only deposit of the kind known in those regions. It is from four to eight feet thick and is so situated that quarrying will be easy.

Slate has been discovered in large quantities in the western part of Mason county, Wisconsin, and Chicago capitalists have secured options on much of the land in that vicinity. The slate is said to be of good quality and easy to quarry.

The regular force of help at Booth & Flynn's stone quarries, Greensburg, Penn., is more than 500, and the monthly pay roll averages $20,000. Last year 2,723 car loads of stone were shipped from the quarries. The latest improvements are two large revolving polishing tables.

An important discovery of mosaic and black marble and of fossil iron ore has been found in Alleghany county, adjacent to Clifton Forge. Cincinnati capitalists have an option on the property at $40,000.

L. L. Dyer, superintendent of the Colton Marble Works, Los Angeles, Cal., says that they have just quarried the largest block of marble ever taken out in the state. When squared it will be 15 feet long, 5 feet and 4 inches wide, 6 feet and 5 inches thick and weighs 25½ tons. Just imagine a single block of marble that size and weight! It is to be cut up into marble slabs 14 feet fong, 5 feet wide and two inches thick, and will be used in the telephone company's new building at Los Angeles. Another huge block of the same size is being quarried.

Oxford Granite Company, Oxford, Me., have shipped three large granite blocks to Mechanic Falls and are filling an order for foundation stock in Lewiston. A new ledge has recently been opened on the company's purchase of fine dark granite that will enable it to fill orders direct from its own quarry for fine cemetery work.

The Berlin & Montello Granite Company, of Chicago now owns both granite quarries in Berlin, Wis., the Wisconsin company, usually spoken of as the Bannermann quarry, having concluded the sale of its quarry to them. Mr. Bannermann will continue to operate his quarry in the town of Warren, seven miles from Berlin, in Waushara county.

Gray & Sons, Lee, Mass., have secured the contract to erect the large marble arch of the state house at Boston.

A fine bed of sandstone has been discovered at Hamblin's addition, Battle Creek, Mich., and a quarry will soon be in operation. The rock will make excellent paving material.

The large deposits of slate long known to exist on the south side of the Arkansas river, in Colorado, five miles east of Salida, on the Denver and Rio Grande railway, are to be opened up and their product placed on the market. The deposit in its main course, as located by survey, stretches for one and a half miles south of the river and the government has now issued patents for the two sections on which it lies. A company is being organized in Denver to operate the quarries and the deal

is expected to be closed in a few days, the product being already spoken for by leading Denver architects for use in building.

About 25 miles east of Spokane, Wash., is a deposit of granite which, as yet, has never been worked. The quarry is the property of J. H. Stone, who is now about to take steps to develope it. Mr. Stone has had samples of the granite examined by experts, who have pronounced it equal to the best granite of New England. At the present time Mr. Stone is busily engaged constructing trackage facilities to the quarry, preparatory to setting a gang of men to work opening up and developing his underground treasure. There is a likelihood that Spokane will hear more of this granite quarry shortly.

Graham county, Arizona, has some excellent limestone quarries and D. M. Thatcher has experimented by burning a quantity 12 miles from Solomonville on the east side of San Simon. He reports the supply of rock from which this lime was burned to be inexhaustible. All the lime heretofore burned in that vicinity has been inferior and very dark in color. This is white as snow and of superior quality.

A force of 15 to 20 men employed by B. E. Goodsell at Cliff Haven quarry, Bluff Point, near Plattsburg, N. Y., is getting out building stone for which purpose another large derrick has been placed in position. A superior kind of black rock or limessone dotted with red specks has been discovered which may turn out to be black marble and specimens have been shipped to Burlington, Vt., to be polished. If it proves to be marble the quarry will be worked to a considerable extent.

Extensive operations in the quarrying of building stone are now going on at the Neshamminy Falls, Penn., quarries, on the Bound Brook railroad. The quarry is located on the south side of Edge Hill, and a good quality of stone is being obtained. A contract has been taken to furnish stone for bridge work on the new Frankford branch of the Reading railroad, now building from Logan Station.

A company of Hudson, Mass., men is developing a marble quarry on the Seth Lee farm in Sheffield, Mass., and stone of pure white and fine quality is obtained.

FOR SALE, WANTED, ETC.

Wanted—Some good marble setters. Apply or address DAVIDSON & SONS, Chicago, Ill.

WANTED Position as manager or foreman in cut-stone. Capable of taking charge of whole or any part of the cut-stone business. Fifteen years' experience. Correspondence solicited. Address, WALTER GRAVESON, 367½ W. 7th-st., Cincinnati.

WANTED—A first-class foreman to take charge of stone-yard, working from 30 to 40 sandstone cutters. Must be practical, energetic and experienced with plans and soft stone. Permanent situation guaranteed to the right man. Address P. S. C., care STONE.

QUARRY FOREMAN WANTED.—Applicant must be an active, pushing man of experience in granite quarrying, modern in his ideas and methods, and capable of taking full charge of rough stone department. State where last employed and wages expected. Address, "Granite," care of ' STONE."

WANTED, SITUATION—By a first-class man, as agent or manager for a building stone quarry company. Is thoroughly posted in both the sale and quarrying of stone. Fifteen years experience. First-class reference given. Would prefer the west. Address, A. W., care of "STONE."

FOR SALE—A tract of 160 acres of extra fine oolitic land, located one mile south of Bloominton, and one-half mile from L.,N. A.& C. railway track. Stone has been fully tested, core drilled, and have begun stripping quarry; channeling to begin soon. Will sell in tracts of 20 acres more or less. S. C. DODDS, Bloomington, Ind.

WANTED, SITUATION—A thoroughly practical man of large experience in all details of marble or monumental work, would like to act as superintendent of the business for a good city or country shop; or would open up a new business in good locality, with party able to furnish about $5,000 capital. Address, B. Granite, 573 Plymouth-ave., Buffalo, N. Y.

WANTED, SITUATION—By practical man in marble and granite cemetery work, and any class of building-stone work. Posted in every department of stone-work ; 45 years of age ; 25 years' experience; 19 years as foreman, etc.; very best references as to ability and reliability; strictly temperate and steady; permanency at reasonable pay preferred. Address S. C. BRINK, Independence, Ky.

B

STATUE IN OOLITIC LIMESTONE.
Cross & Rowe, Bedford, Ind., Sculptors

STONE

VOLUME V. NOVEMBER, 1892. NUMBER VI.

THE MARBLE REGION OF KNOXVILLE, TENN.

REFERENCE to a geological map of eastern Tennessee shows a broad band of Trenton limestone extending quite across the state in a northeasterly and southwesterly direction, bounded upon the east by the Unaka mountains and on the west by the Cumberland table Lands. The Trenton, in fact, underlies the entire region commonly known as the Valley of East Tennessee. Though all belonging to the Trenton terranes, the limestones throughout the belt are by no means uniform in composition, nor regular in structure and arrangement. Referred to their original horizontal position, the various beds in the entire series lie as follows, beginning with the lowest: (1) Blue limestone with many fossils, 200 to 600 feet in thickness; (2) Chocolate red, pink and variegated and highly fossiliferous limestone (marble) 380 feet in thickness; (3) Blue shale 400 feet in thickness, and lastly, the so-called Iron limestone 250 feet in hickness.

t Although now discontinuous, the marble beds, according to State Geologist Safford, once covered a long area reaching from the northern part of McMinn county to the Virginia line north of Rogersville, an area some 120 miles in length by 20 miles in width. Before the Appalachian chain assumed its maximum elevation, they formed the bottom of shallow seas, where lived and died the multitude of corals and crinoids whose calcareous rem iins constitute so large a bulk of the stone, and so beautifully diversify it. But the forces which gave birth to this mountain system threw the beds into a series of folds the main axis of which run parallel to the mountain system; to the heat and pressure incident to this folding we owe the crystalline structure and general metamorphism, whereby the stone assumed the physical qualities essential to their use for decorative work. Subsequent

erosion has cut down the tops of these folds, leaving the remnant beds sometimes steeply inclined and often badly shattered and decomposed.

An idea of the position of the marble beds as they appear in Knox, Blount, Loudon and Monroe counties, may be gained from the accompanying map compiled from data obtained by the United States Geological Survey, the original being in the possession of Mr. J. J. Craig Jr., of Knoxville, to whom we are indebted for the privilege of its reproduction here. As will be perceived the marble areas, represented on the map by the heavy dark lines, are comparatively narrow, greatly elongated in a northeast and southwest direction, and often very sinuous. They reach their maximum width, that is to say, thickness, in this particular case, in the region adjoining, and to the southwest of Knoxville.

FIG. 2.

NEWLY OPENED MARBLE QUARRY ON LINE OF MARIETTA AND NORTH GEORGIA R. R. SOME 17 MILES S. W. OF KNOXVILLE.

The view shows the irregularly eroded surface of the beds due to superficial solution by water.

As is usually the case but a small portion of the beds here shown are capable of yielding merchantable marble. This for a variety of reasons, prominent among which are the facts that (1) The original character of the sediments was not uniform over the entire area, and not all of such a character as to yield stone of good quality on metamorphism: (2) The beds were not infrequently badly shattered during the upturning, whereby the production of sound blocks of merchantable size is rendered impossible: (3) The beds are not infrequently too deeply covered with worthless debris, whereby the work of stripping is rendered excessively costly, and (4) Terrestrial waters have in many cases dissolved out portions of the stone along lines of weakness and fracture leaving the sound material behind, not in continuous beds, but only in rounded bowlderlike masses. Indeed this last named condition of affairs is peculiarly characteristic of the region, and to it is due the too prevalent impression that the Tennessee marbles are not to be found in

solid beds at all. That such a view is due to an exceedingly limited knowledge of the region under discussion, will become apparent as we proceed, though that such an idea should have originated is by no means strange when we observe the surface appearance of the stone and the very superficial manner in which it has in most cases been quarried. This peculiar bowlder-like character of the superficial beds is well shown in Fig. 2 from a photograph of the Knox and Brown quarry on the Marietta and North Georgia railroad, some seventeen miles southwest of Knoxville. The opening here, at the time the view was taken, (June, 1892) was some 200 feet in length, but so far the work had been confined to stripping, no actual quarrying having been undertaken. The surface waters acting for many years have sought out each line of weakness through which they have permeated, gradually dissolving out the material, leaving the sounder part of the stone in the rounded masses as here shown. Nevertheless the character of the beds varies greatly throughout the area. In places the stone lies nearly horizontal and in beds from two to six feet in thickness; sometimes in continuous beds, or again in disconnected masses, originally continuous but now divided by joints which by percolating waters have been widened into fissures. (See Fig. 3.) These last are often filled with a red tenacious clay, the insoluble residual constituent of the stone, and which aside from being a nuisance, involves a considerable outlay for its removal. In other cases the beds dip, as shown in Fig. 4. Obviously in such cases the cost of working must increase as the beds are followed into the hill, but obviously also, the character of the stone as regards soundness is likely to improve. It may, however, not be out of place here to call attention briefly to one point, the full importance of which did not impress itself upon me until after leaving the

FIG. 3.
MARBLE QUARRY NEAR JUNCTION OF FRENCH BROAD AND HOLSTON RIVERS.
The view is characteristic and illustrates the apparent lack of continuity of the beds.

region. The erosion and solution of the stone being due to surface waters, must be more or less superficial, and hence it is a fair inference that the deeper one goes the larger will be the blocks obtainable. It does not necessarily follow, however, that the blocks will be sounder, since the percolating waters have, in their work of destruction, only followed out lines of weakness, the "checks" and various flaws by which the stone was traversed. It is the soundest part of the bed that is left, and, indeed, were it not for the residual clay and other debris, this natural, though wasteful method of quarrying could scarcely in all cases be considered a drawback. That the stone sometimes occurs in massive, heavy beds is well shown by the view (Fig. 5) given of the old Concord quarry, No. 2. The beds dip here towards the southeast and are so sound that slabs of any desired size can be cut across, or with, the bedding. The stone is the granular variety. The figure in the middle background will serve to give an idea of the relative thickness of the beds.

In color the Tennesse marbles are variable. That first brought into notice was a highly fossiliferous dark chocolate stone variegated with white. To many persons this is still the only 'Tennessee marble." Beautiful as are many of these varieties, with the chocolate or even red groundmass, often variegated with large white fossils, (Orthocera) they are by no means the only, nor at present the most sought marbles of the region. Just now the demand is more for a uniformly warm bright stone that may be used for interior decoration where the chocolate variety is too dark or too somber. Such a stone is found in the granular gray and pink beds immediately underlying the fossiliferous variety. These are the beds that are now receiving the greatest amount of attention, and which may well claim equality with any stone now on the markets. Slabs ten by four feet, or six feet square, are readily obtained free from all flaws and blemishes, giving over every inch of surface a finish like enamel and requiring no filling whatever. I think it may truthfully be claimed that, with the possible exception of the white and blue-gray marbles of Vermont, there are upon our markets, from whatever source, no stones which are in this respect the equals of the pink and gray varieties of this region.

The Tennessee quarries are in many instances peculiarly favorably situated for the shipment of their product. In those at the junction of the French Broad and Holston rivers an inclined railway takes the blocks to the water's edge, where they are loaded upon scows, or lighters, which are then chaperoned by a stern-wheel steamer down the stream to the railroad. In other instances short branch lines are built to the main road. It must be confessed that so far as the writer could learn, a deplorable lack of business foresight and energy has thus far been displayed by the railroads to whom these branch lines are tributary. Little encouragement seems to be offered

in the way of building the lines or other inducements such as might result in vastly increasing their own carrying trade. Indeed throughout the region the managers seem yet to learn that there may be methods of building up an extensive traffic, either in freight or passengers, other than by begrudgingly accepting that which is practically forced upon them. In still other cases it is necessary to haul the stone by wagon to the nearest railroad. Obviously quarries thus situated labor under great disadvantages, since the character of the soil is such that good roads can be maintained only at a very considerable outlay of time and labor. As a matter of fact, such are, with one or two possible exceptions, not maintained at all.

Marble quarrying in east Tennessee began in 1838 with the organization of the Rogersville Marble company, with headquarters and works at Rogersville, in Hawkins county. The stone was first brought prominently to public attention by its adoption for the interior decoration of the United States capitol building at Washington. Stone for this purpose was obtained from quarries opened by the government at a point some nine miles southwest of Rogersville, on the banks of the Holston river. For many years nearly the entire supply of the so-called "Tennessee marbles" was drawn from quarries in this vicinity, but of late years, owing to the more easy accessibility of the stone in Knox and Blount counties, together with a growing demand for the pink granular over the variegated varieties, there has been a decided change, and the quarries of Hawkins county produce but a relatively small proportion of the entire output.

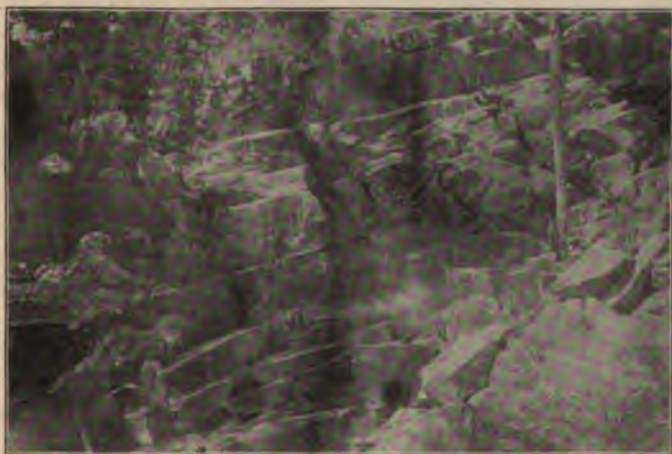


FIG. 4.
MARBLE QUARRY NEAR JUNCTION OF FRENCH BROAD AND HOLSTON RIVERS.
The view shows the dipping of the beds.

The methods of quarrying in the Tennessee regions differ a little from those elsewhere employed. The Wardwell channeling machine, so efficacious in the Vermont fields, is here little if at all used, owing to the uneven nature of the surface, and the lack of continuity of the beds. The Inger-

soll quarry bar and ordinary steam drill are the main reliance, though the Knox system of blasting whereby large blocks may be lifted by a single hole charged with but a few ounces of powder, and this, too, apparently without shattering or otherwise injuring the material, bids fair to do away with either. The quarried material is in large part shipped in bulk to New York and other large cities, to be there worked up as occasion demands, and the piles of huge blocks lying about the quarries and shipping yards, all nicely squared and free from defects, are very impressive. Nevertheless a not inconsiderable proportion is worked up in the yards at Knoxville. W. H. Evans & Sons of Baltimore, have here an extensive mill, under the en ergetic management of Mr. J. E. Willard. Another large establishment is operated under the direction of Mr. J. E. Hart, president of the East Tennessee Stone and Marble Company.

FIG. 5.
MARBLE QUARRY ON LINE OF EAST TENNESSEE, VIRGINIA AND GEORGIA R. R., NEAR CONCORD, KNOX COUNTY.
The quarry was temporarily abandoned at the time the view was taken, but well illustrates the heavily bedded character of the materials.

The marble industry of East Tennessee is as yet in its infancy. After what has already been said regarding the early history of the quarries this may seem an unwarrantable statement. It is nevertheless true, and the causes though various, are not far to seek. First, there is an unlimited supply of marble of excellent quality and sufficiently diversified in color and texture to meet the demands of an everchanging and capricious fashion. In nearly every instance a granular, pink or rose marble immediately underlies the red and chocolate variegated, so that both varieties may be produced at the same time or alternately, as occasion demands. Until recent years, attention has been given mainly to the variegated, fossil bearing varieties. The use of this stone must always be somewhat limited. Its color is as a rule too dark for wainscoting, excepting in well-lighted rooms, and the market for it for furniture purposes must always be too limited for an extensive industry. Of late years the use of oak and other hard woods for the latter purpose has so far taken the place of marble, that

many of the old quarries are now lying idle from this cause alone. (2) The use of marble for interior decoration has but begun in America. Within the past ten years there has been a wonderful change in this respect, and the number of private and public buildings which are erected annually in our large cities, and which are richly, even elaborately decorated with the most expensive marbles, is increasing at a marvelous rate. (3) At present there are known within the limits of the United States no marbles superior to the "Gray Knox," "Peach Blossom," "Maiden's Blush," and other varieties from near Knoxville. Sound, clean, with clear warm tints, they rank with the best the world can produce. Singularly enough, too, the value of these lighter varieties for building purposes seems up to date, to have been almost wholly overlooked. Knoxville itself, the very center of the marble industry, is a city of mud-colored brick and wood. The postoffice building of the "Gray Knox" and a recently erected church of Georgia marble are the only stone buildings of importance within the city limits. Yet it is safe to say that there is lying on the dump piles of the numerous quarries enough stone of the very best quality to practically rebuild the city. The stone is thrown upon the dump simply because the blocks are not of such size and shape as to pay to ship for sawing into slabs as decorative marble. At a very small expense such blocks, now worthless, or used only for lime-burning, and road-ballast, may be reduced to such size and shape as are needed for building. Such stone, however, is shown to best advantage in rock-faced work. The postoffice building, already mentioned, is tool dressed. The individual character of the stone is thereby entirely lost. It appears only as a dirty whitish material, and might almost as well be of cement. Rock-faced work, showing the clean fracture and glistening cleavage facets of the calcite, as well as its warm tints, would be much more effective, as well as cheaper, since the cost of the tool worked or sawn surfaces, is nearly double that of rock-faced.

An important item which has heretofore mitigated against the Tennessee stone, is the unbusiness-like methods of quarrying pursued in times past. Owing to lack of capital, to lack of proper knowledge of quarry methods, or to what you will, the country has, to use a popul ar and not inappropriate phrase. been simply "hogged" over, or "badgered." That is to say the quarries are little more than holes such as might be dug by one of the indigenous razor-backs, or industrious but indiscriminating badgers. This condition of affairs is shown, in a mild form, in Fig. 6. Owing, we will assume, to lack of capital, it has apparently been necessary that the quarry should pay expenses from the very start. A minimum amount of stripping was done, and attention given to the taken out of merchantable blocks at once. The present alone was regarded ; the interests of the future overlooked. As a natural, an inevitable, consequence, the quarry shortly became in that condition suggested in the illustration, where, buried in its own debris, further

work, without too great an outlay of time and money, will be impossible. The quarry must be abandoned and fresh sites found elsewhere. The iniquity of the system is fully recognized by a majority of the present operators, who are now, as in the other views shown, devoting a greater outlay to the preliminary work of stripping and clearing, trusting to the future for a return of the money thus invested.

Still another fact that must operate strongly in favor of the quarries of Tennessee, as well as those of the entire South, and particularly with reference to those producing building material, is the perfectly assinine course pursued by the granite workers of New England during the past six months. It is safe to say that no policy could be devised by the worst enemy of the New England workman, none better calculated to ruin the stone industry in the North, and, as a supplemental consequence, to build it up in the South than that which has resulted in the strikes still in progress, at the time this is written, throughout the New England states. It is, however, an ill wind that blows nowhere, and just in proportion as the Eastern granites are driven from the markets by short-sighted labor unions, the pink and gray Tennessee marbles may find their place, if the business is managed at all efficiently. Other items which can but favor the further development of the quarries of this region, are the equitable climate and low prices of labor, mechanics and laborers receiving but from $1.00 to $1.50 per day as against $1.33 to $1.87 in Vermont and $2.00 to $3.00 in California. The output of marble for the entire state of Tennessee during 1889, as given by the eleventh census, was 309,709 cubic feet, valued in the rough at $419,467, twenty-nine quarries and some seven hundred and fifty employes being engaged in its production. This amount is less than one tenth the produc-

FIG 6.

MARBLE QUARRY NEAR KNOXVILLE.

The view illustrates the difficulties under which work is now prosecuted in some instances where insufficient preliminary stripping has not been done.

tion of the entire United States, but in making comparisons it should be remembered that the statistics for the other states include building marbles as well, while those of Tennessee are for decorative stone only. So that while the state stands but fourth in the list as a producer, so far as actual quantity is concerned, being outranked by Maryland, New York and Vermont, in point of value of quarried material she stands second, being outranked only by Vermont. This in itself speaks well for the superior quality of the Tennessee stone.

In closing the writer cannot refrain from expressing his thanks to the many gentlemen connected with the marble industry of Knoxville and vicinity, but for whose many attentions little could have been accomplished during the limited time at my disposal. Prominent among them should be mentioned Mr. J. J. Craig, Jr., Mr. T. S. Godfrey, Mr. J. E. Hart, Messrs. Knox and Brown, Mr. J. Ed. Ross and Mr. J. E. Willard.

Geo. P. Merrill.

OFFER TO TEST INDIANA STONE.

MR. W. F. M. GOSS, director of the Engineering Laboratory of Purdue University, Lafayette, Ind., writes to STONE as follows:

That the record of the Engineering Laboratory of Purdue University, concerning the building stones of Indiana may be made more complete, we will agree until further notice to test, free of cost, any sample of Indiana stone that you may send us, or cause to have sent us; and we will also agree to return a report giving facts as found concerning the same; all under the following conditions:

1. Every sample must be shaped up in the form of a two-inch cube ready for testing.

2. Every sample or set of samples must be accompanied by a statement giving name and address of party interested in having the test made; the county and the part of the county from which the sample is taken; the name of the quarry, if a quarry is worked; the depth below the surface from which the sample is taken; and when possible the date when the block was quarried.

3. The statement must be certified to as correct by a resident freeholder in the county from which the specimens are sent.

We make this concession believing that the information we secure will be worth to us as much as the price which we ordinarily ask for testing. Where no statement is sent, or where the stone is from out of the state, the usual charge of $1.50 per cube will be made.

It should be understood that the results of all tests will be made a matter of record at our laboratory. No public use will ever be made of individual tests that can in any way operate to the disadvantage of parties interested. The report returned will give facts only. The university will express no opinion as to the value of the thing tested. The opinion of a professor acting in his individual capacity could be obtained, but this would need to be the subject of a specific inquiry.

SANDSTONE INTERESTS OF NORTHERN OHIO—II.

TWENTY-FIVE miles west of Cleveland at the junction of the Cleveland, Cincinnati, Chicago & St. Louis Railroad, commonly known as the "Big Four," and the Cleveland, Lorraine & Wheeling Railroad, is the town of Grafton, where are located the extensive interests of the Grafton Stone Company, and the Elyria Stone Company. The first mentioned company is the largest operator in the "Berea" district after the Cleveland Stone Company. It began operations in 1865 under the title of the Black River Stone Company, and its product for many years consisted wholly of grindstones. In 1879 it merged into a stock company under its present title. It is officered as follows: E. S. Flint, president; W. E. Miller, vice president and general manager; Col. S. Bliss, treasurer, and W. S. Miller, secretary. Their possessions extend nearly in a semi-circle for several thousand feet and are constantly being added to. Not more than twenty feet of stripping is necessary and good stone is found for a distance of sixty to seventy feet. A peculiar and valuable feature of the stripping lies in the fact of its having a stratum of the best sand for sawing, which is superior to lake sand and about pays for the stripping, while the balance is a fine clay that has been made into the finest red facing brick.

The stone is buff with about twenty feet of blue on the lower level, and divided into beds of nearly the same arrangement as the Amherst stone. These are free from fractures. Views of their two principal quarries will be found in the combination picture on another page. That shown in the upper right hand corner is the west quarry and that in the lower corner is the old Black River quarry. Over forty car-loads per day of building stone are produced from these quarries. The buff and blue split rock is extensively used in many of the finest buildings in Pittsburgh, Philadelphia, New York, Washington, Baltimore, Boston and Toronto, in all of which regularly established offices of the company may be found.

In addition to building stone, these quarries produce upwards of fifty tons of grindstones daily. The company owns the right of way from the village into its possessions and operates the Grafton & Brunswick Railroad connecting with the railroads before mentioned. A branch of the Baltimore & Ohio is contemplated which will also connect with the road of this company. There are six gangs in their saw mill, a remarkably clean plant by the way, having good drainage and careful attention.


PLANT OF
THE GRAFTON STONE CO.
GRAFTON, OHIO.
C. D. HEIM.

This mill should be twice its present size and would have been enlarged ere this had it not been that Mr. Miller's experiments with crushed steel have demonstrated that the output has been doubled by its use. The mill runs night and day and has a capacity of 60,000 cubic feet per month. The saw-gangs are driven by a pair of engines coupled to the same shaft, each of eighty-horse power. There are two boilers and steam plants operating the saw and two turning mills.

One hundred and seventy men are employed in the quarries and mills assisted by four Wardwell channelers, six Ingersoll drills and fifteen derricks and hoists. There is besides a wood and mounting shop for small grindstones. The latter are made to any required size and graded for various sorts of work. This firm received a medal from the Centennial Exposition on their grindstone exhibit. This branch of the business possesses so much of interest and has so many important features peculiar to itself, that the writer has procured the necessary material for an illustrated article upon the industry which he hopes to present to the readers of STONE before long. The immensity of the plant is here demonstrated by the panoramic view shown in the combination picture.

To the south of Grafton at a distance of half a mile from the junction of the two roads converging there are the possessions of the Elyria Stone Company. This concern was organized Nov. 1, 1891, but the quarry property had been operated by several different organizations and partnerships for about six years previous to that time. H. E. Corning is president, W. L. Fay is secretary and treasurer, with headquarters at Elyria, several miles distant.

The output of the quarry has been constantly increasing and the demand has always been greater than the capacity of the quarry. Every year new machinery has been added and the facilities for production increased. They expect during the coming winter to largely increase their present capacity by additions of new machinery and buildings.

Their president for a number of years was connected with the Ohio Stone Company, the Grafton Stone Company and the partnership known as the Elyria Stone Company in various capacities. The secretary and treasurer, previous to the formation of the present company, was engaged in manufacturing business.

They own and operate about 16 acres, and have about 100 men on their pay roll, who are assisted by three channelers, three steam drills, seven steam hoists, on horse hoist, three steam pumps and ten derricks.

They have one saw-mill with eight gangs, using what is known as the box or gravity feed. They expect to increase the number of gangs this winter.

They have gone down in their quarry about sixty to seventy feet in rock

in the deepest part and are going down at least thirty feet more and perhaps still further. They have very little stripping, probably five to six feet in order to reach paying rock. The layers are thin on top, being from four to six, ten, twelve and thirty feet in thickness. The color is what is known as blue or light gray. The crushing strain when on two-inch cube was 32,000 pounds. The chemical analysis as shown by Prof. Jewett, of Oberlin, O., is as follows:

	Per Cent
Silica	87.66
Moisture	.43
Iron in the sesquioxide condition	2.13
Iron in the protoxide condition	1.39
Calcium	.17
Aluminum	1.72
Magnesium	.20
Carbonic oxide	1.60

As a building stone it has been used in the Alpha Delta Phi hall, which is built of this stone, of Amherst College, Mass. A large Methodist church of New Rochelle, N. Y., many city buildings of Philadelphia, Pa., and largely used in the construction of many of the buildings in nearly all of the principal cities east of the Mississippi river. Owing to the closeness of the grain and hardness of the stone it has been used in jails, penitentiaries and other government and private buildings requiring a hard and tough stone. It is largely used as a flagging stone and takes the lead where its superior qualities have become known. They are shipping about 150 car-loads of various kinds of stone from this quarry per month.

Take it all in all, the Grafton quarries are esteemed peculiarly fortunate in having stone possessing entirely different characteristics from any in the district in which they are generally classed. Its divergence from the Amherst and Berea rock gives it a kind of monopoly. Chemically it is about the same as that quarried in the counties adjoining, but seems to have been silted from the finer sand particles that formed the original deposit. It works very smooth and is capable of a semi-polish. Stone bridges of 150 feet span have been constructed with it that show no signs of deterioration. It resists climatic changes, also fire, and the high regard vouchsafed it by architects is evidenced by the photographic collection at the office of the Grafton Stone Company. Mr. W. S. Miller, the secretary, with commendable enterprise, has had views taken of every job in which Grafton stone has figured and he and his lieutenants use them effectively in introducing the stone in new sections. In fact, to the spirit of enterprise dominant in this district may be attributed to the success which these concerns enjoy. Good stone and good management have brought prosperity.

Ira P. Rowley,
Artist Editor STONE.

THE CANADIAN ASBESTOS INDUSTRY.*

UNTIL 1879 Italy supplied nearly all the fibrous asbestos required by the world, but in that year a number of companies were formed to work the veins known to exist near Thetford and Black lake, in the Province of Quebec, Canada. Since then, owing to the constantly extended use of woven asbestos, the working of this mineral has become of considerable importance. According to the official statistics of the Canadian geological survey, the value of the asbestos in Canada in 1891 was $1,000,000, being exceeded only by that of coal, nickel, copper and petroleum.

This industry is now in the hands of thirteen incorporated companies, having an authorized capital of about 3½ million dollars of which 2¼ million are according to Mr. Klein, invested in the industry in Canada.

To prepare the asbestos for market two operarations are necessary, viz.: the mining proper and cobbing or separation of the asbestos from the adhering serpentine, At most of the mines the drilling is done by steam or compressed air, 45 feet of hole per day of 10 hours in the former case and 50 to 55 feet in the latter being considered a fair day's work at an average cost of seven to eight cents per foot of hole drilled. At present there are in use seven compressors, with a total capacity of 44 drills, and there are 44 steam drills.

The average cost of drilling amounts to three and one-half cents per ton of rock broken.

Dualin, which contains 35 per cent. nitro-glycerine, and costs 20 cents per pound, is the explosive used; it is fired by electricity. The expense for explosives is about 3 cents per ton of rock. The broken rock is roughly sorted in the pit, the waste rock being sent to the dump by wheelbarrows, or in the larger mines by derricks and the crude asbestos to the cobbing sheds. The cost of this averages 25 cents per ton of rock.

The second and most important part of the work is the dressing or cobbing of the asbestos and then grading it, This grading is generally done by hand by boys. Some of the mines have, however, partially or entirely adopted machinery for this purpose, in order to avoid the loss of asbestos contained in the so-called cobbing stone, *i. e.*, large pieces of rock with a vein of asbestos in it, which did not separate by the blast, and which can only be separated by heavy sledge hammers or by crushing.

The first to try to solve this problem was the Scottish-Canadian Asbestos Company. Their plant consisted of a Blake crusher, traveling picking

*Abstracted from a paper read before the General Mining Association of Quebec, by L. A. Klein, M. E.

tables, Cornish rolls, revolving screens, elevators, chokers and blowers.

The mines of this company were closed during 1888, and it was not until the winter of 1890–91 that the American Asbestos Company started to experiment in this direction, the main object being to do away with what is known as grade No. 2. At this plant the crude asbestos is conveyed by an inclined railway, and automatically dumped in front of a Blake crusher, the jaws of which are set at 1½ inches. The crushed ore drops on an inclined sieve in shaking motion, which separates all the loose fibre and the dust from the larger pieces of rock and asbestos veins, the former going directly to the cleaning or grading machines, the latter dropping on a revolving picking table, where the barren rock is removed by hand to one side of the table, the asbestos veins being left on the other. At the end of the table is a receiving chute which is divided into two compartments, and into which rock and asbestos are discharged respectively. The rock drops from the chute directly into a larry and is wheeled to the dumps, while the asbestos is conveyed either to the kilns, necessary in winter time or rainy weather, or to the fine crushers for further treatment. These latter are of unique construction, of which the object is to allow particles of a certain size and loosened fibre to go through, without being further crushed, as thereby the asbestos fibre is likely to be injured. This so reduced stuff is brought to the cleaning and grading machines, consisting mainly of a set of inclined sieves in rapid shaking motion in connection with blowers, fans, etc., while the remaining unbroken stone and unloosened fibre goes back to a set of still finer crushers to undergo the process again. The plant at King Brothers' mines in Thetford, which was principally erected for the extracting of asbestos out of large pieces of rock on the old dumps, which some years ago did not warrant the expenses for block-holing and further handling, consists of a Blake crusher, from which the stuff is conveyed on a set of Cornish rolls, with the intention of having all stone reduced to powder, from there to a revolving screen, of which the object was to screen out all the dust and leave the clean fibre. This object, however, has not been fully realized, owing to the failure of the rolls to break up the rock entirely, and an additional blowing and screening plant has been put in, which produces now a very clean product of one grade.

The Anglo-Canadian also runs a crusher and a set of sieves, and the Johnson's company has recently put in a couple of crushers to overwork the old dumps. None of the processes at their present state, however, may as yet be considered complete, the main difficulties being two:

1. That, if asbestos is crushed with a considerable amount of stone, until the latter is reduced to powder—the long and most valuable asbestos is partially destroyed.

2. If the stone is not entirely reduced before grading, it is nearly impossi-

ble to free the fibre from the stone, and a large amount of waste is the result.

The cost of cobbing, according to Mr. Klein, varies considerably, according to the quality of material. While some asbestos will break from the stone very easy, other requires considerable labor; then larger veins will sooner be gathered than small ones. He places it, including the breaking of the cobbing stones, at $7 per ton at the leading mines.

The asbestos after being graded, which is, however, in the entire discretion of every particular mine, is put in bags of 100 pounds each. Cost of bags are from 5 to 6 cents each; cost of bagging, 20 to 25 cents per ton. The cost for transport to cars and loading vary from 10 to 60 cents a ton, according to distance from railroad.

In estimating the cost per ton of asbestos Mr. Klein says: "On this subject the opinions of the asbestos quarrymen are very different, and while some claim to mine only 50 or 60 tons of rock to the ton of asbestos, others go as high as 150. I am of the opinion that as a rule the quantity of rock mined to the ton of asbestos is greatly underestimated. Basing, on the capacity and actual work of our machinery appliances, the known quantity of larry loads removed from a mine during a year, and the known average weight of each load, in relation to the totals of asbestos produced, I hold that one ton of asbestos to 100 tons of rock is a fair average. If we accept this the cost of production of asbestos may be set down as follows: drilling, 3½ cents; blasting, 3 cents; labor for removing rock and gathering asbestos in the pits, 25 cents, making a total of 31½ cents to the ton of rock, or $31.50 to the ton of asbestos; $7 for cobbing; $1.50 for bags and bagging; 50 cents for loading; $5.50 for supplies, which includes fuel, tools, iron, steel, timber, other materials and repairs; $6 for general business expenses, such as management, insurance, offices, marketing and others; $3.55 10 per cent. wear and tear, calculated on a total of $355,000 in plant, making a total of $55.55 to produce one ton of asbestos. If we calculate now that we have to pay interest on a total invested capital of about two and one-quarter millions of dollars, for which at least 10 per cent. must be expected, we have in our sales to average aprice of at least $80 per ton of asbestos."

The output of asbestos in 1880 was but 380 tons, valued at $24,700. Since then, the industry has steadily increased, with the only exception of 1888, and reached in 1890 8,860 tons with a value of $1,200,240. During the period between 1880 and 1890, the increase has been nearly 2,600 per cent. in tonnage and 5,100 per cent in value. Since 1880, the prices have been as follows: 1880, $65; 1881, $65; 1882, $65; 1883, $72; 1884, $65; 1885, $58; 1886, $59.75; 1887, $49; 1888, $60; 1889, $69.75; 1890, $127; 1891, $111. During this time the imports of asbestos by the United States has increased from $9,786 in 1880 to $254,935 in 1890.

RECLAMATION OF THE ZUYDER ZEE, HOLLAND.

FOR some years past, we may almost say for some centuries past, or ever since the Zuyder Zee was formed by terrible storms in 1219 and 1282, a project has been under consideration to drain that great inland bay, to reclaim the land and make a new area available for cultivation, and work is now in progress on the dam to shut out the North Sea. When the sea was first formed as many as 100,000 people and seventy-two villages and towns were destroyed, so that an incidental effect of these reclamation works will be the recovery of many interesting and pathetic relics. The situation of the lake and of the dam are shown on the accompanying maps. The foundation of the dam already extends from near Ewijeksluis, in North Holland running from the north point of North Holland across to the island of Wieringen, and thence straight across the Zee to Makkum, a point on the opposite coast of Friesland, a distance of only eighteen miles. It has been found that as the work advances the sea itself assists by depositing enormous quantities of sand and silt every tide on both the outside and inside of the dam which is being gradually raised along its whole length simultaneously. Subsequently a canal

MAP SHOWING LAND TO BE RECLAIMED FROM THE ZUYDER ZEE, HOLLAND.

is to be constructed to connect Harlingen on the north coast of Friesland with the remaining part of the Zee, a small area in the center which will be called the Yssel Meer, and left as a lake, and with the North Sea. When the project of draining the Zee took shape forty years ago, the first idea was to join by dams the great islands of the Texel, Vlieland, Terschelling, and Ameland to each other and to the main land at each end. The total length of dams required for this would have been only the same as that from Wier-

ingen to the Friesland coast, and it would have reclaimed from the sea about as much again as the present plan; but the tide going in and out through the openings four times daily, with tremendous strength, and in enormous volume, could not be coped with. It had hollowed out deep channels between the islands, from which it was considered vain to attempt to dislodge it. When the tides have been excluded altogether, subsidiary dams will be built and the water pumped out into the sea. The amount of land shut off by the dams as thus finally completed may be as much as 1,000,000 acres of which fully 750,000 acres will consist of rich clayey soil, indicated by hatching on the accompanying map, as recent borings have demonstrated. The remainder, the Yssel Meer, connected with Amsterdam and the mouth of the Yssel by navigable canals, will on account of its future elevation above the level of the North Sea, serve as a fresh water basin for the adjoining territories.

CROSS SECTION OF PROPOSED DAM ACROSS ZUYDER ZEE, HOLLAND.

The great dam, the cross-section of which is shown in accompanying illustration, for which we are indebted to the "Centralblatt der Bauverwaltung," is to be constructed in an average depth of 13 feet to 19.7 feet of water. To secure its foundation against undermining by the tides, mattress work is employed. On the outer side a part of the dam is to be constructed of fascines to a height about level with low water. The lining of the slopes also consists of fascine mattresses and stones. The top of the dam is to be 16.5 feet above low tide; its crown being 6.5 feet wide. The berm to the lake side is to carry the tracks of a railway line from North Holland to the province of Friesland. The material used in the construction of the dam is earth, obtained principally from excavations for the drainage and navigation canal across the island of Wieringen, the location of which is shown on accompanying map. The twenty-four flood-gates to be constructed will have a width of 41 feet each and are arranged in six groups, the twenty-four openings aggregating 984 feet in width. At the side of those two locks of 26.2 feet and 45.9 feet width respectively will be provided. The canal itself is to be 3,280 feet wide with a depth of 14.4 feet within the locks, narrowing subsequently to a width of 1,640 feet. It is estimated that the value of the reclaimed land will be vastly in excess of the estimated cost of the work which is stated to be about $95,000,000. The amount of redeemable land will be saved as stated above, 750,000 acres at least, and its value is reckoned at $400 per acre. The value of the new province will thus be some $300,000,000, of which sum more than two-thirds will be net profit on the enterprise. These are said to be conservative estimates, and not likely to be exceeded. The work, therefore, promises to yield

enormous immediate profits, while its ultimate value to the kingdom is incalculable. It will add more than 10 per cent. to the area of Holland, with all that that implies in increase of population, wealth and industry. It will also materially modify the climate of the provinces of Utrecht, Gilderland and Oevryssel, and will make great changes in their commercial and industrial conditions.—*Engineering News.*

THE BUSINESS MAN AND HIS CLERKS.

THE world credits the American business man with being industrious and careful, and to those qualities, quite as much as his native shrewdness, is attributed his wonderful success. He is a worker in all that word implies, and all unite in accrediting to him a closer attention to the details than is given by men of other countries. Employes overlook this fact, and they look upon their employer as a man who has profited by their labor, not stopping to think of the hours of toil and trial that they have passed through. The workman has his fixed hours for labor, and when the day's work is done his mind is not tormented with thoughts of the morrow; but with the employer there are no stated hours for work, his only limit is the few hours not given to sleep. The hours in his shop when superintending his work are his easiest hours. His severest toil is that of providing ways and means for conducting his business. To do this he must find customers, watch commercial affairs, look to credits, see that the work produced is such that will sell well, guard against waste in every department, be ready to meet competition without loss, and to so systematize the workings of the factory and office that loss will be reduced to a minimum, and the office will always be provided with funds to meet all demands upon it. His life is one continuous round of labor, and the closer attention he pays to the details, and the more prosperous his business, the better it is for the workmen. Then, too, the more active the man, the closer his connection with his business and with his relationship to his workmen, the less the friction between employer and employe.—*The Hub.*

MODEL OF NEATNESS AND ART.

STONE is a model of neatness and art, as well as valuable reading matter."
—*W. Williams, Huntington, Pa.*

THE AREAL WORK OF THE U. S. GEOLOGICAL SURVEY.*

WHEN the United States Geological Survey began its work some twenty years ago, only a small portion of the public domain was mapped out, so that the first thing to be done was to prepare a topographical map. It was not considered then, nor is it considered now, necessary to prepare a detailed map; all that was and is desired is a map giving the main landmarks and the contour lines, surveyed and drawn with just sufficient accuracy for the scale of the map and no more. It was at first decided to use the scale of four miles to the inch throughout most of the domain and employ the scales of two miles and one mile to the inch in more important centers. However, the methods of survey have been so much improved since then, and the cost per mile so much reduced in consequence, that it has been found consistent with economy to abandon the four-mile-to-the-inch scale, and subsequently the two-mile-to-the-inch scale was abandoned also. This adoption of the one-mile-to-the-inch scale was also rendered necessary, as it became evident that the requirements of geologists would not be met satisfactorily by the smaller scales. The total area surveyed topographically to date is 537,000 square miles, distributed over forty-two states and territories. Four states, viz., Connecticut, Massachusetts, New Jersey and Rhode Island, together with the District of Columbia, have been completed. Each sheet of the maps is about 15x18 inches and the side of the one-inch-to-the-mile map represents 15 minutes of latitude. The sheets are engraved on copper and are printed from stone transfers. Each sheet is printed from three plates, giving respectively the hydrography in blue, the altitudes between contour lines in shades of brown, and the topography in black. Altogether 615 sheets are now printed in the different scales out of the 694 sheets surveyed for. No legal provision has yet been made for the public sale of these maps.

No system has ever yet been uniformly adopted among civilized countries for representing the geological structure and characteristics in maps. Most geological authorities at present adopt some arbitrary system of coloring according to their own taste and fancy, so that the art of geological mapping may be said to be only in an experimental stage as yet. The system adopted by the United States Geological Survey is novel, and is thought to meet the requirements of engineers, miners, etc., in a better way than any other method yet proposed or tried. The system provides for the separation of rock formations into four classes, viz.: 1. Fossiliferous or fragmental; 2. volcanic; 3. granitoidal and schistoidal, and 4. superficial. These classes of rocks are represented by ground colors and pattern overprints in such a manner that the entire range of available colors may be used for each. The fragmental rocks are represented by the primary colors in orderly arrangement, each

*Abstract of a paper read before the American Institute of Mining Engineers.

color indicating an age-group (Carboniferous, Silurian, etc.). These colors, used as uniform ground tints and overprints in line patterns, represent the distinct formations of which the group is made up. The volcanic rocks are represented by angular figures either on a white ground or over a ground tint representing an age-group. The crystalline rocks are similarly represented by hachures disposed either irregularly or in such a manner as to indicate structure. The superficial deposits are represented by round figures in such a manner that they may be mapped in their normal relation, overlying the older rocks, on the sheets showing the underlying formations. The general system provides for the representation of the geology on the topographical maps. The atlas sheets are colored in manuscript by the geologists in the field and the geological symbols are afterward engraved on zinc. In order to make these sheets available for all uses, provision has been made for printing each sheet in portfolio form, supplemented by as many different impressions of the same map as may be required. Thus the portfolio will usually include a topographic sheet without geological symbols; a geological sheet showing only the age-groups and formations; a structure sheet in which sections drawn to scale are printed on a sheet showing the groups and formation boundaries; sometimes a sheet of columnar sections showing the structure in greater detail; in some cases a sheet showing the superficial deposits only; and, when the occasion requires, a sheet of mineral resources, showing the location of mines, quarries, coke ovens, smelters and furnaces as well as mineral areas.

These geological surveys consume much time. Moreover, a variety of circumstances have combined to delay the completion of the surveys except in special districts, such as the Lake Superior iron region, the quicksilver and gold regions of California, the phosphate belt of Florida, the Eureka and Virginia City districts in Nevada, and some mining areas in Colorado.

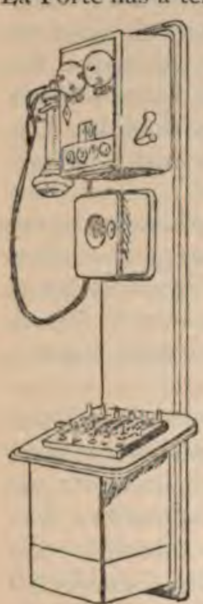
Final geological surveys of greater or less extent have been executed in thirty-two states and territories. These surveys cover an area of 117,000 square miles, and are in part represented on 100 regular atlas sheets and a large number of special maps.

The cost of the topographical surveys has varied with the scale and other conditions from less than $1 to over $5 per square mile. The average cost of the survey, including drawing, has been $3 per square mile on the one-mile-to-the-inch scale and the total cost since the first has been about $4 per square mile. The cost of the geological survey has varied between much wider limits. In fairly representative districts the cost has averaged $5 to $6 per square mile. The average cost from the beginning has average l $8 per square mile, but this cost includes preliminary expenditure on instruments, books, laboratories, etc.

W. J. McGee.

STROWGER'S TELEPHONE ATTACHMENT.

TELEPHONE girls are not fashionable in La Porte, Ind. In fact, there are none, although that thriving town has between sixty and seventy of Mr. Bell's instruments in use. The subscriber just presses the button and the ingenious mechanism invented by Mr. Strowger does the rest. Central office, instead of being filled by the hum of feminine voices, is deserted and lonesome save for the presence of a man, who goes around about every two weeks with a sprinkling-can and fills the battery jars with water. La Porte has a telephone system that is unique and without a parallel. It is a system that looks after itself, and each and every subscriber makes whatever connection he desires without outside aid and by tapping out the number on a keyboard. It is the first practical demonstration of the utility of the Strowger Automatic Telephone Exchange, and if the tests made recently are any criterion of the value of the invention, the company, which is said to have \$5,000,000 invested, is in a fair way to reap a golden harvest.



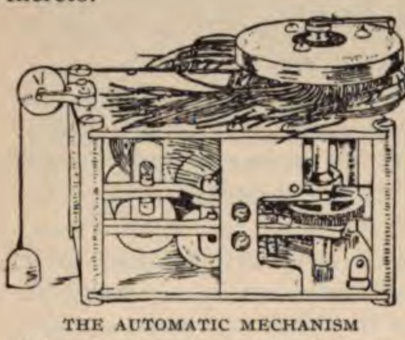
THE TELEPHONE

The circuits are completed in La Porte and Nov. 3 was selected as the time for making an exhibit before capitalists and scientific experts. The invitations were scattered with a liberal hand and there were 100 people to make the trip into Indiana.

To return to the train. It was nearly 1 o'clock when La Porte was reached. As the special drew into the Union Depot Mr. Charles I. Wickersham did the bowing and smiling for the rest of the crowd and led the way to the central telephone office, No. 705 Main street. The stairs safely climbed, the capitalists and scientists assumed graceful poses, while the newspaper men secured seats around the long oak table in the center of the room. H. H. Craig the New York agent of the company acted as master of ceremonies. He welcomed the visitors and then introduced Mayor Scoot of La Porte, who extended the freedom of the city and then said he had given the Strowger automatic telephone a personal trial and was glad to announce that its performances were better than the promises made by the company. Finally Mr. Strowger, the inventor of the system, was introduced, and for ten minutes he spoke of the pleasure it

afforded him to witness such a consummation of the many weary hours he had spent in perfecting his invention. He reviewed the history of the telephone, the trials of the "hello" girl, and the work imposed upon the recording angel by the failure of the apparatus or the aforesaid girls to do their work properly. He then said:

From nearly the very first the idea of an automatic switch has been eagerly sought for, yes, it seems that one has been demanded. As early in the telephone world as 1879, though only fourteen years ago, yet telephony was scarcely three years old at that time, a patent for an automatic telephone exchange was taken out, and thousand upon thousands of dollars sunk in its behalf, but all to no purpose. To prove that an automatic telephone is among the probabilities, and that it is possible to do away with the objectionable features of the central office, is the object of our meeting here to-day. This is no new telephone nor an improvement thereon. It is as much separate and apart from the telephone as the copper wire over which we seem to talk. Nor is its sphere confined to a telephone. In coast defenses it can be brought into play where any one particular submerged torpedo can be exploded by its use. With it a superintendent of a railroad can hold private telegraphic communication with any operator along the line. I repeat it is not a telephone nor a telegraph, but it is a valuable adjunct thereto.


THE AUTOMATIC MECHANISM

Then the practical exhibition of the working of the system was perfectly successful, and in a few minutes visitors were talking with the owners of every telephone in town, each doing his own calling.

The method is simple. On the shelf of the ordinary Bell telephone is a row of keys marked hundreds, tens, units, and a release key. The subscriber who wishes to place himself in communication with some other subscriber taps out the desired number on the keyboard, which automatically connects his wire with that of the person with whom he wishes to speak. Suppose, for instance, that a subscriber wishes to communicate with No. 123. He simply presses the key marked hundreds once, the key marked tens twice, and finally the key marked units three times. His wire is then in electrical contact with that of subscriber 123, and he can ring the bell and converse with him in the same way and with as much ease as if he had been wrangling with central for five or ten minutes. The means by which this is accomplished is not as simple as the method. The whole mechanism takes up a space of 6 x 4 x 4 inches. This piece of apparatus is placed in the cent-

ral exchange and takes the place of the telephone girl. As for the subscriber's end of the line, there is nothing more than an ordinary telephone with a row of keys upon its shelf. The mechanism at the station consists chiefly of a circular disc constructed of hard rubber, or any other suitable non-conducting material, and this is the central feature of the machine. The disc is provided with perforations in circular rows of 100 each, these rows being about one-twentieth of an inch apart. Through these perforations extend the wire connections to the main line wires, so that the wire of every subscriber in the exchange comes to the instrument and passes through one of the perforations, ending in a good metallic contact slightly raised above the face of the disc. A circuit-closing arm is made in parts, of which one is a circuit-closing sleeve firmly attached to the lower end of a sleeve rod. Within the circuit-closing sleeve is closely fitted a circuit-closing needle held in such a manner as to be in perfect electrical contact with the wire terminal by a spring. A rod is located along the axis of the cylinder and is free to rotate and move longitudinally. The lower end of this rod is sleeved and into this is inserted the upper portion of the ratchet rod. This sleeve construction allows the ratchet rod to have a longitudinal motion only, thereby keeping the ratchet teeth continuously toward the attendant pawl. The ratchet rod is provided outside of the cylinder and conveniently below it with a series of ratchet teeth, by means of which the rods are moved longitudinally. Two wheels, through which the rods extend with a feather and groove connection, are made in contact with the ratchet teeth and levers having pawls pivoted in their ends. Each lever has a vibratory movement, and is oscillated by the alternate energizing and de-energizing of an electro-magnet, thereby imparting motion to its adjacent ratchet teeth and consequently the circuit-closing needle. Each pressure of the push button at the exchange, made at the will of the operator, causes, through the channels thus described, the circuit-closing needle to move from row to row and from wire to wire.

When any supposed conversation is ended the person hangs up the ear phone and presses the release key. This causes the magnets to be energized, attracting the armatures, thereby withdrawing the several pawls from their engagement with the ratchet teeth and allowing the circuit closer to fall and return to its initial point. The subscriber is never isolated from the exchange. Suppose that two persons are in communication with each other, and a third wishes to speak with the first. He can tap up the number and make sufficient connection to ring his bell and call his attention to the fact that some one wishes to speak to him, so that the first subscriber can then at will release his instrument from the one with which he is in connection and connect with the third man, or he can continue his own conversation until finished, when, upon pressing the release key, he will

find himself in connection with the third person. The outside party, however, can not either speak with the other party or listen to the conversation, he can only obtain sufficient connection to ring his bell. Although there are only seventy-five telephones in operation at La Porte the claim is made that 6,000 wires can be successfully run into a machie with only a five-inch disk. The electricians of the company are also at work upon a device which, when a telephone is in use, will register on that machine the number of the instrument wishing to make connection.

The Strowger Automatic Telephone company of Chicago was incorporated Nov. 18, 1891, under the laws of the state of Illinois. The capital stock is $5,000,000, and the officers are M. A. Meyer, President; A. B. Strowger, Vice-President; and J. Harris, Secretary.—*Chicago Tribune.*

FLEXIBLE GLASS.

ECKSTEIN, an Austrian engineer, claims to have discovered a strong and flexible substance, as transparent as the ordinary brittle glass. His process is as follows: From four to eight parts of collodion wool are dissolved in sufficient ether or alcohol; this solution is intimately mixed with from 2 to 4 per cent. of castor oil or other non-resinous oil, and from 4 to 10 per cent. of resin or Canada balsam. This mixture is spread on a glass plate, and dried under the influence of a current of hot air, by which it is transformed in a comparatively short space of time into a transparent, hard, vitreous plate, the thickness of which can be regulated as desired. The material thus obtained is said to resist the action of salts, alkalies, and acids, and, besides being transparent, is odorless. It is flexible and almost unbreakable. Its inflammability is much inferior to that of other collodion combinations, and it can be further reduced by the addition of magnesium chloride, while an admixture of zinc white produces an ivory appearance. Any color or shade may be imparted to the new glass.

OUR FRONTISPIECE.

N former issues of STONE much has been said relative to the carving qualities of Bedford oolitic stone and in this number we present an occular demonstration of it in the statue of a boy which serves as a frontispiece. A careful examination of this exquisite piece of work will reveal the same minutiæ of detail that is found in marble sculpturing. This is but one of many beautiful jobs emanating from the prosperous establishment of Cross & Rowe at Bedford, Ind. It was carved by David Richards, who took for his model the son of Dr. Chas. Raridan, of Bedford. The statue represents a boy who has been engaged in despoiling a mother bird of her belongings, and with the nest containing the eggs in one hand and the tail feathers of the recent occupant of the nest in the other, he gazes regretfully up to where she has flown. Observing closely, you will see how delicately the detail has been chiseled out of the stone. The chubby fingers and toes, the dilating nostrils, expression of boyish excitement, even the strands in his straw hat are brought out clear and sharp, and in the boy's face is found an expression more real than that generally looked for in figures of this kind. It has been suggested that this statue enter into Indiana's stone exhibit at the world's fair, a suggestion that will doubtless be acted upon by those interested.

The same sculptor contemplates chiseling an elephant from a huge block of Bedford stone in time for the Columbian Exposition. Just now the firm of Cross & Rowe are kept exceedingly busy getting out new designs in rustic and rock-faced monumental and lawn work, in which they stand pre-eminent. They have now been in the wholesale rustic business for over two years and at the time the artist editor of STONE visited their establishment, thirty-five men were employed. They use over one hundred car-loads of stone in a year. It is all of the oolitic variety quarried in the vicinity of Bedford. Their rustic monuments, vases, chairs and settees find their way into every state in the union, and so popular has this rustic effect become that many monument commissions have adopted it.

The initial "I" used at the beginning of this article represents imperfectly

a soldiers' monument erected by them at Ulhrichsville, O. The writer has visited it and can testify to its great beauty and the complete satisfaction of those who gave the order for it. The statues of the men are life size, the tree twenty feet high. Other monuments of a similar character have added to the excellent reputation enjoyed by this firm for turning out tasty and well executed rustic work, and with a continuance of popularity and rapid growth it gives promise of rivaling establishments longer established and using marble or granite exclusively. The durability of the Bedford stone is unquestioned. It resists climatic changes and hardens with age. This accounts for its adaptability for monumental purposes.

TRANS-ATLANTIC NOTES.

THERE is talk of a projected combination in the Italian marble trade which is to be a big thing. The prime mover in the matter is an American who has lately spent some months in Italy settling preliminaries. It is said that satisfactory arrangements have been made with most of the large quarry owners, and that further developments may be soon expected. I have had an interview with the leading spirit in this business who seems sanguine of success. He was eloquent on the possibilities of the combination and the scheme certainly looks workable. The white marble of Carrara is antique. Nothing like it can be produced in the wide world. The industry is one of the oldest in existence. The quarries have been worked continually for more than 2,000 years. The material does not need introduction. It is known wherever there is a civilized community. The trade is a solid one. More than 200,000 tons of Italian marble is quarried annually. A small increase in present prices would not check consumption to any appreciable extent and would produce large profits. The theory is all right. We shall see how it works out in practice.

One of the busiest parts of London is Picadilly Circus. It is to be beautified by, what those who have seen the designs declare to be, one of the finest street ornaments of its kind in London. This is the much-talked-of fountain by Mr. Gilbert. The fountain is entirely of bronze and is of circular shape. In place of the usual up-cast spray of water, the better effect of falling water has been obtained. Welling over from basin to basin, it is designed to give a delightful air of coolness to a spot where the heat and bustle of traffic is at the greatest. The work is in progress but will not be finished for some months to come. At present the foundations are being laid, and the stone steps built which lead up to the fountain.

The *Hawk* which is said to "a smart paper for smart people" tells the

following story as an instance of how "a neglected grave has been made the means of extracting money from sympathetic survivors:"

"A certain naval officer found himself in a foreign port, exceedingly short of money. It happily occurred to him that his mother's father—a distinguished man—was entombed there. He telegraphed for twenty pounds to put the monument of his grandfather in thorough repair. The money was sent at once and the young naval officer subsequently informed me that the job only cost him two bottles of wine given to the blue jackets, who executed the task with mops and buckets brought from the ship."

In labor matters a new departure has been taken by the Rotherhithe local authorities. They have resolved to invite tenders for paving work from the Amalgamated Union of Street Masons, Paviers, Stone Dressers and Hammermen. At a special meeting of the Union it was stated that the officials at Rotherhithe had agreed if the tender of the Union was successful, to advance money from week to week to enable them to carry on the work. It was unanimously decided by the Union to tender for the work under the conditions laid down. The progress of the experiment will be watched with interest. It has already excited much comment. One enthusiast declares that it will be the means of opening a new era in the relations between labor and elected bodies. A London newspaper is of opinion that if a union of workmen can be invited and can accept the invitation to carry out a contract direct for a public body, it is obvious that the middlemen with his apparatus of sweating and sub-letting, can be altogether eliminated from public undertakings. It is calculated that the profit of the middle-men being deducted, the work can be done as efficiently while the highest possible scale of wages is paid. These are rosy forecasts. I hope they may be realized. So far, past experience has proved that an army without officers is useless for fighting purposes, and that in this battle of life the much abused employer of labor is of some small use after all.

In the current number of *Macmillan's Magazine* there is an interesting article on "Some New England Architecture," by Mr. A. G. Hyde. The writer is severe on what he calls "the American architects' inability to combine art with a paramount desire for much returns on invested capital." "Before the war," says Mr. Hyde, "the American architect often blundered, but he did not as a rule lose his sanity or perpetrate monstrosity. After the war he did both." It was during the sudden expansion of the Northern towns and villages in the prosperous years immediately following the great struggle that the "ordinary American architect and the American carpenter together lost their wits and their morals." But if Mr. Hyde thus criticises the present he is hopeful about the future. "America," he concludes, "is yet young; her work thus far has been tentative; and with the besom of conflagration a constant factor in her development, and an effectual agent

for removing her blunders, when not too substantially perpetrated, her future is as rich with possibilities for architecture as for every other kind of human achievement."

The city of Bristol is making a bold bid for the transatlantic passenger traffic. The citizens are about to promote a bill in parliament for the making of a new dock at the mouth of the river Avon. This dock is to cost over a million pounds sterling and will accommodate the largest steamships afloat. The principal lock will be 800 feet in length and will open into the waters of the river Severn. It is calculated that travelers between London and New York will save some hours by adopting the new route; and that in the item of coal alone, a steamship line, with weekly sailing of first-class ocean steamers, will save £100,000 per annum as against steamers sailing from Liverpool. The railway journey between London and Bristol only occupies two and one-half hours. At present the mails between London and New York are carried overland to Holyhead and thence transhipped to Kingstown for Queenstown. When the new dock is completed, the mails will be carried in less time by making shipment from Bristol direct and the cost of the long overland journey will be saved. It is calculated that the new route will be open in about five years from the present time.

Arthur Lee.

CRUSHING TESTS OF STONE.

THE process of determining the resistance of a stone to crushing by tests upon sample cubes is simple in principle, but not wholly free from difficulties in application. Every stage of its development, from the cutting of the sample cubes to the final work of crushing, requires intelligent and skillful manipulation. Moreover, the character of the problem makes it of prime importance that every party concerned in the work should have a just appreciation of the part performed by every other party. For example, he who prepares the cube should know something of the precise way in which his finished product is to serve its purpose; again, the results of the final test cannot be of highest value unless the previous history of the cube is known. From these considerations it would appear that in so far as mutual interest exists, it should serve as a close bond between the quarry and laboratory. The present article is offered as a contribution which in some slight degree, may assist in perfecting this bond.

The testing machines used in crushing sample cubes, are always some combination of a weighing scale with means for producing stress. Different machines vary greatly in form. The general principle of all is illustrated by the sketch, Fig. 1. This sketch shows a table A, supported by a knife-edge which forms a part of the lever B. The table and the lever, with the attached weight-holder, constitute the scale. Any weight placed upon A may be balanced by appropriate weights at the end of the scale beam B. For example, if a cube of stone (E) be placed on A, its weight may be determined by the weights which are required to balance it at B; or if A be pressed upon, as with the hand,

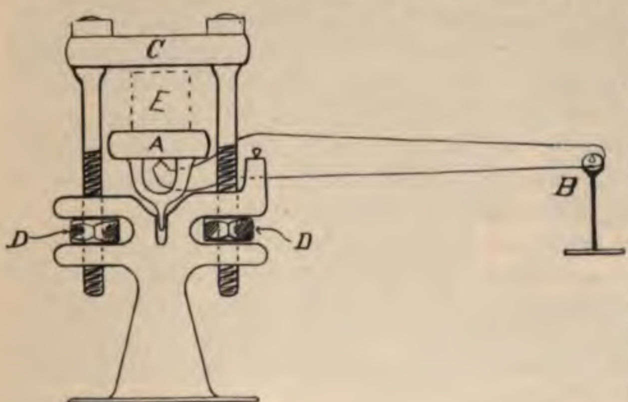


Fig. 1.

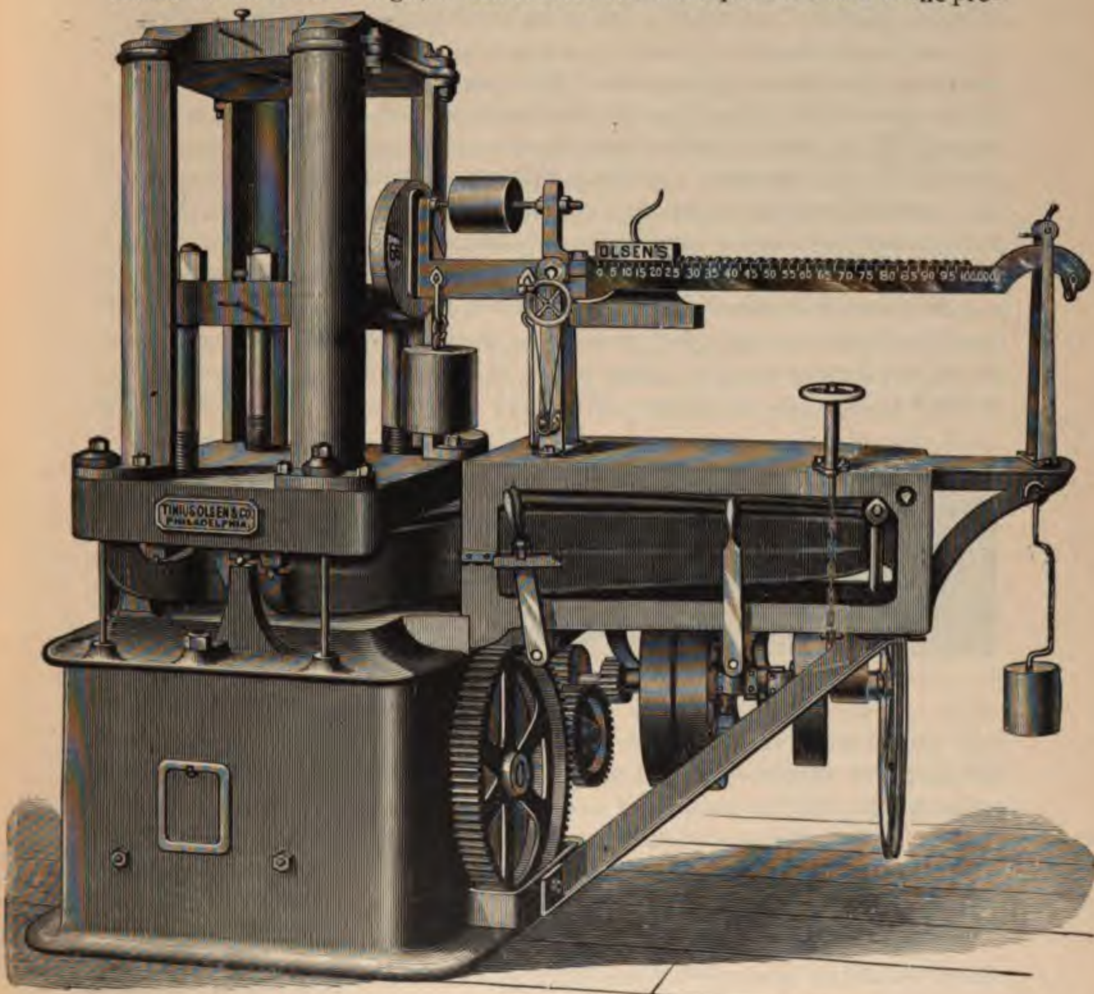
the beam B, if previously balanced, will rise. In other words, whatever be the weight imposed or the pressure applied at A, its value may always be determined by balancing B, as would be done with any scale. For producing stress there is above A, a plate C, connected by screws with the nuts D D, which bear against projections on the frame of the machine. By turning the nuts D, the plate C may be brought in contact with the upper surface of a cube of stone resting upon the scale bed A, and if the motion of the nuts be continued, C may be made to press heavily on the cube, which in turn will transmit the stress it receives to the weighing plate A, from which point its value is determined as already described. If the stress upon the cube E be gradually increased until it gives way, and if the beam B be maintained constantly in balance, then the weights at the end of B, at the time the stone gives way, will represent the crushing resistance of the specimen. This will serve to make clear the principle of all testing machines for compression, though the stress is not always applied by means of screws. The sketch is purely ideal, and does not represent the form of any existing machine.

The Olsen 100,000 pound machine (Fig. 2) in the laboratory of Purdue University has a combination of levers so arranged that the plate A is supported on knife-edges near each corner. It has four screws and the nuts which engage them are connected with a train of gears and are driven by power. The machine is complicated by attachments which adapt it for use in testing specimens under tension, and for transverse testing.

The necessity for carefully-prepared specimen tubes will now be apparent. If the two surfaces which are to receive pressure are not perfectly plane and parallel, the faces of the testing machines will not bear with a uniform pressure, and the effect on the specimen is that of unequal loading. At one time experimentors sought to take up inequalities in the surfaces of the cube by interposing a thickness of sheet lead, making practically, a leaded joint between the stone and the machine. It was found, however, that under the heavy pressure needed to crush a specimen, the lead would squeeze out of the joint and that its flow from the center to the outside brought new stresses on the specimen, which resulted in early spalling and in the giving way of the specimen at a pressure lower than that which it would have withstood had the lead not been used. Then thin layers of wood were tried but the use of this material has generally been abandoned. It is now agreed among experimentors that a thickness of hard card-board, which is almost non-compressible, is the most that should be interposed between the stone and the machine, excepting where the surface of the stone is rough, or where it has only slight irregularities. In the latter case a thin film of plaster of paris may be used. The plaster, when applied in a

thin film, will not give way under pressure sufficient to crush the hardest stone.

The success of the precautions taken to secure a uniform loading of the specimen may generally be judged during the progress of the test. If one corner of the cube is high, it will receive the most pressure and as the pres-



sure is increased it will spall. This will sometimes happen long before the maximum pressure is reached. If the spalling begins early and continues throughout the test, it is evidence that the specimen is being broken by piecemeal. In fact any yielding of the stone much below the maximum stress, must be accepted as evidence that the stone either is not of uniform

strength or that it is not uniformly loaded. The former condition does not often apply to cubes as small as those experimented upon. Early spalling, therefore, may usually be looked upon as proof that the work of testing is not being well done.

Another means of judging the value of a test is to be found in the form of the fragments. Experience shows that a homogenous specimen crushed by a uniformly distributed load breaks up into two pyramids, each having one of the faces receiving pressure for its base, and a point near the center of the cube for its apex. The material forming the parts of the cube about these pyramids, breaks up into thin layers, small fragments, or even into fine powder; usually, with a loud report as the stone gives way. The presence of the pyramidal forms after crushing, has come to be accepted as proof of uniform loading, and hence, an evidence that the work of testing has been well done. In Fig. 3, is shown at 1 a cube of Bedford stone. It is split by vertical seams running across in both directions. The faces of this cube which received the pressure in testing, were high toward their center and the stone broke up first at one point and then at another. It is needless to say that no reliance should be placed upon results obtained

FIG. 3.

from such a test. At 2 is shown a piece of red sandstone after crushing. In this specimen the pyramidal form is plainly seen. This specimen showed no weakness until the maximum stress was reached when it went to pieces at once. The test was obviously a good one. At 3 is shown the pyramidal form obtained from a sample of paving brick, the fragments in this case being removed.

The process of preparing a cube is one requiring careful attention. A record should be made giving the exact point in the quarry from which the block that furnished the material for the cube was taken. If the stone is of such a character that a decided change is brought about by seasoning, the date of quarrying should be noted.

The possibility of faults entering into the work of testing makes it desirable that more than one cube of a kind be submitted for a test. The exact

number will vary with the importance of the work, in anticipation of which the tests are to be made. At least three should ordinarily be submitted.

The necessity for having the two faces of the cube which are to receive the pressure plane and parallel has been made clear. It may now be stated that the side faces also should be in good shape in order that they may be accurately measured; otherwise the area of the section under the stress cannot be easily determined.

The results obtained from the sample cube apply only to the stone in that part of the quarry from which the block was taken. Just so far as it may be assumed that the cube fairly represents, by its quality, the quality of the stone at other points, just so far it may be assumed that the results obtained from the cube represent the value of the stone at other points. If there is a decided difference in the stone at different levels, it is obvious that its comparative value for these levels can only be determined by a series of comparative tests of the cubes taken from the several levels in question.

Finally, in working up the cube, the saw and the rubbing bed should be the only apparatus used. In the softer stones especially, the effect of a hammer blow is likely to extend considerably beyond the point on the surface which is struck, and the result is a weakening effect within the body of the specimen. When, however, blows are unavoidable, they should be light, and the cube should be roughed out at a size considerably larger than that as finished, and then rubbed down to size. Sawing is without question to be preferred.

The size of the finished cube is by custom two inches on a face. For purposes of comparison it is desirable that all cubes be of this size; but small variations in the dimensions of different cubes will not invalidate results for any purpose. Each cube should have placed upon it a number or some other designating mark. If it is desired that the pressure be applied to the bed faces of the stone, the mark should be on one of these faces. The report of results which will be returned from the laboratory will generally refer to the samples by number.

William F. M. Goss.

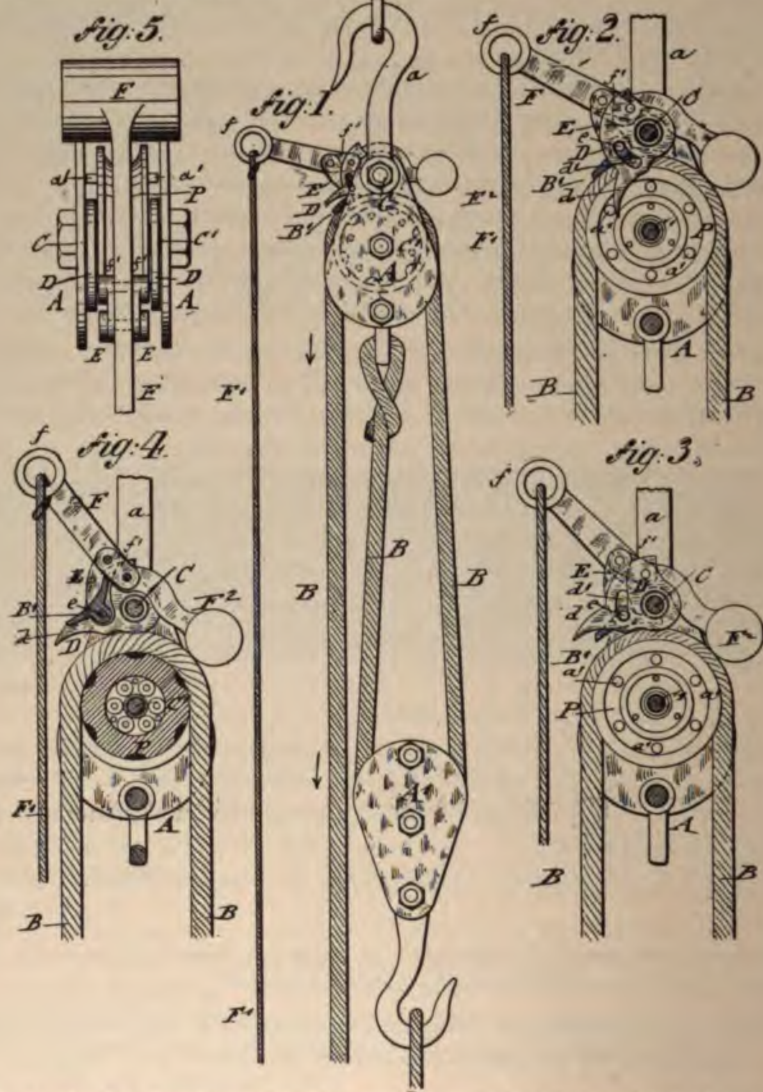
MISSED A GOOD THING.

THE Old Dominion Stone Company, of Alexandria, Va., in subscribing for STONE says: "We cannot see how we have done without it as long as we have."

A HOISTING TACKLE.

SPECIFICATION forming a part of letters patent No. 471,308, dated March 22, 1892, issued to John Farrell, of Huntsville, N. J., describes a new design of hoisting tackle, of which an illustration is given herewith.

This invention relates to an improved hoisting-tackle of that class in



which the load is readily operated and suspended in position at any point where it may be desired to stop the load for removing the same; and the

invention consists of a hoisting-tackle the pulley of which is locked by a pawl-and-ratchet mechanism, the pawls of which are pivoted to a cross-bolt of the pulley-block and to a weighted brake-lever arranged above the pulley. The brake-lever is also pivoted to the upper ends of links, the lower ends of which are connected by a cross-pin in arc-shaped slots of the pawls. To the cross-pin of the pivot-links is hung a brake-shoe, that is firmly pressed against the hoisting-rope by the action of the brake-lever and the pawl-and-ratchet mechanism whenever the load is to be stopped, in which case the pawls engage the ratchet devices on the pulley, so that the brake action of the shoe on the hoisting-rope is increased according to the increase of strain on the hoisting-rope. On releasing the pawls by a pull on the hoisting-rope and lowering the brake-lever the former is free to move so as to lower the load. By tilting the shoe on the cross-pin of the pivot-links in an upward position away from the cord the brake action of the same is entirely discontinued, so that the tackle can be operated without any brake action.

In the accompanying drawings, Figure 1 represents a side elevation, showing the same in position for lowering the load. Fig. 2 is a sectional side elevation of the same with one side plate of the pulley-block removed and showing the brake-shoe in position for locking the hoisting-cord. Fig. 3 and 4 are respectively a sectional side elevation and a vertical longitudinal section through the center of the pulley and its brake mechanism, showing the parts, respectively, in position before and after the brake-shoe is placed into tilted position for discontinuing the action of the brake device; and Fig. 5 is a top view of the pulley-block and brake device of the hoisting-tackle, showing the same on a larger scale.

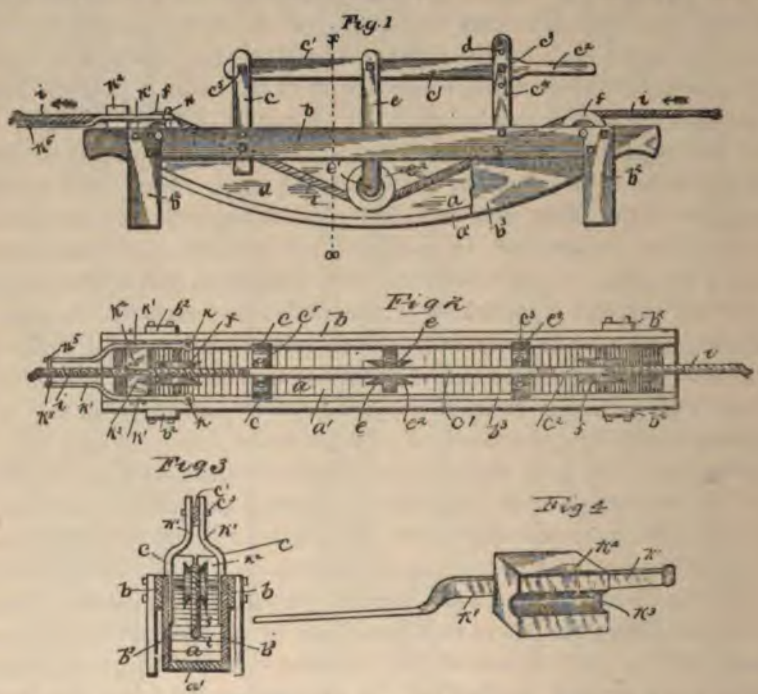
The advantages are, first, that a very effective brake action of the shoe is produced in conjunction with the locking action of the pawls on the ratchet devices on the pulleys; secondly, that the load in being lowered can be wholly controlled by the trip-cord being pulled in a downward direction, which is accomplished by one hand merely, which is an important feature, as heretofore hoisting-tackles of this class had to be lowered by the use of both hands and the joint action of the trip-cord and hoisting-rope; thirdly, that owing to the smooth surface of the brake-shoe no injurious chafing action is produced on the hoisting-rope, while still reliable locking of the rope is obtained by the pressure of the brake-shoe and the friction of the depressions of the pulley on the hoisting-rope, and fourthly, that the action of the brake device can be entirely suspended, if desired.

FULL OF INFORMATION.

I AM well pleased with STONE, and consider it a very valuable work and full of information for monument dealers.—*Geo. W. Harris, Albany, Ore.*

ROPE OILING DEVICE.

LETTERS patent No. 470,000, issued to John A. Hopkins, Murray, O., bearing date March 1, 1892, sets forth the details of a rope oiling device. The invention relates to the improvement of wire-rope-oiling devices; and the objects are to provide an oiling device of this kind of superior construction and arrangement, to provide superior means for adjustably retaining the rope within the oil-box or receptacle, to provide in connection therewith improved means for wiping the surplus oil from the rope after its immersion, to construct and operate said device in a simple and inexpensive manner without unnecessary waste of oil, and to produce other improvements which will be more specifically pointed out herein-



after. These objects are accomplished in the manner illustrated in the accompanying drawings in which Fig. 1 is a side elevation, showing, for convenience, one of the sides partially broken away therefrom. Fig. 2 is a plain view of the same. Fig. 3 is a sectional view on line x x of Fig. 1, and Fig. 4 is a detail view in perspective of one of the wiping-blocks.

From the construction shown and described it will be seen that a simple, substantial, and effective device may be produced by means of which hoisting or other ropes may be quickly provided with a uniform coating of oil or other liquid mixture.

EDWIN and Angelina stood watching the pigs, who apparently manifested a strong reciprocal regard, as they raised their long, lean bodies upon their hind legs and resting their front paws on the top rail of the pen, squealed sympathetically at the young couple.

"They seem very friendly;" said Angelina. "How glad they act to see us. They can scarcely contain themselves, and would fairly leap out of the pen if it were not too high for that. And we have only been here three days, too."

"Ah," remarked Edwin; "the pig is possessed of an affectionate instinct for which he obtains very little credit. Yesterday, I scratched that big fellow's back for half an hour, with my cane; and while he seemed to take no notice beyond a contented grunt or two, yet I evidently touched a tender spot in his heart. Is it not pleasant to think, dear, that the same feeling which binds us so closely together may be found, in a lesser degree, among the most stupid members of the brute creation?"

As Edwin finished speaking, a rough farm laborer strode between him and Angelina, carrying in each hand an overflowing pail of skim-milk which splashed freely over his cowhide boots at every step.

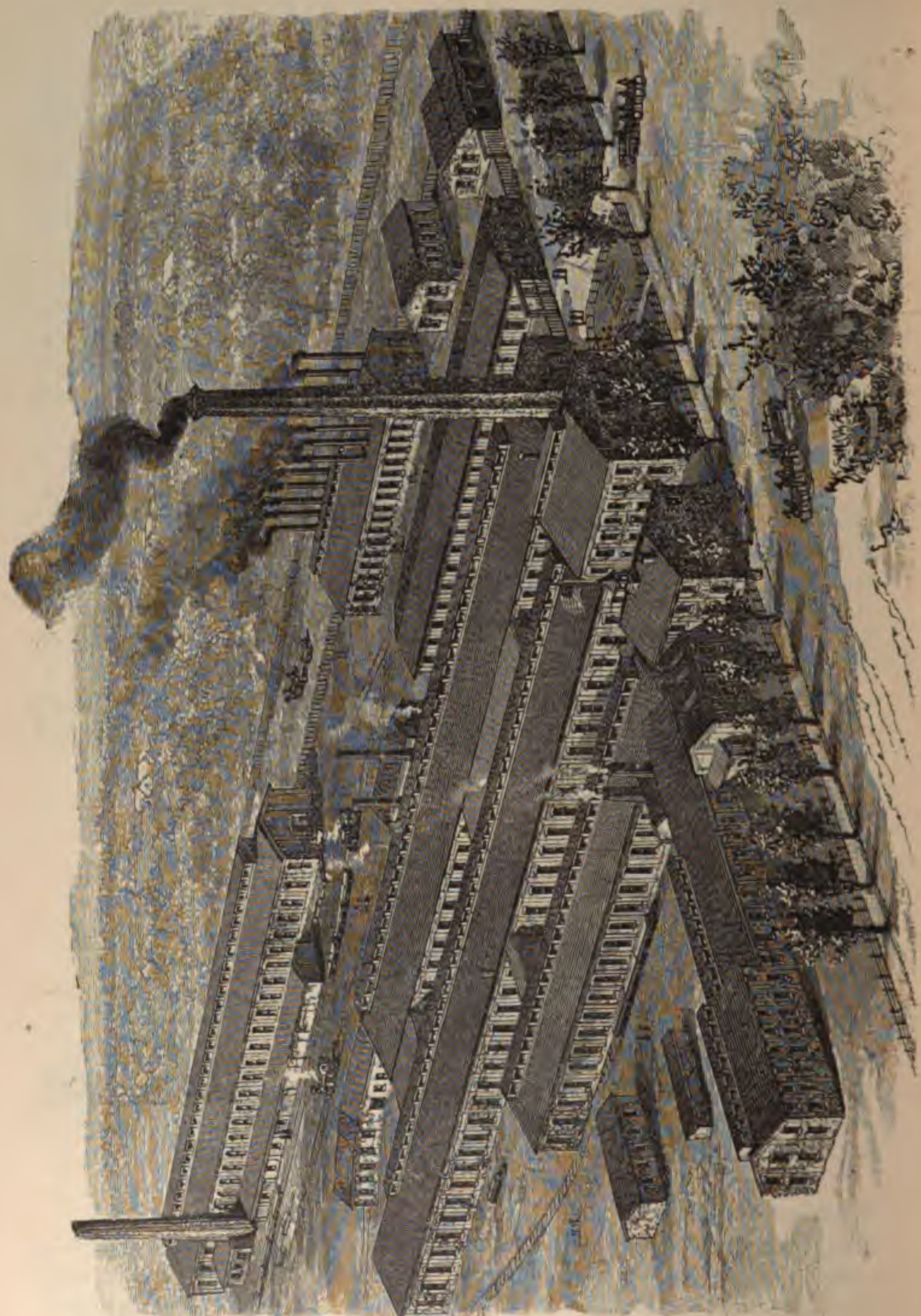
As he neared the pen, the pigs grew frantic with delight and tumbled over each other in their efforts to obtain favorable places at the trough.

Angelina looked mournfully at Edwin. "Oh dear! do you suppose they could have seen that horrid man coming?" she asked.

"I am afraid they did. What fools we were to look for disinterested affection among the lower animals?" said Edwin disgustedly.

And then, as the sound of the supper bell rang out upon the still, evening air, Angelina put her hand in his and they turned and strolled toward the house.

Harry Romaine.



THE ATLAS ENGINE WORKS.

A VISITOR to the Atlas Engine Works at Indianapolis, on seeing the hundreds of powerful engines ready for shipment and in process of erection will be at a loss to imagine where a market for so many engines could be found.

But the legend is familiar throughout the United States, the Canadas, in Mexico and Central America and far south of the equator in Argentina and Chili. Many engines bearing this name are also in use on the Eastern continent. The reputation of these engines has been a growth of many years, and the extensive trade in them has been due to their superior design, economy of fuel and durability of material and workmanship.

The illustrations of the various departments of the works will convey a graphic idea of their extent, especially in the principal details, but many portions are necessarily omitted, as to make it complete would require an entire number of this magazine.

Every imaginable device for the saving of labor has been employed, and the shops are a model of convenience. The average number of men employed is 670; that in busy seasons is increased to 850. The output per year is about 1800 engines of 75 horse power, requiring 50,000 pounds of pig-iron per day, besides large quantities of steel and other metals used in the construction of these engines.

Beginning with the foundry we find 175 men steadily employed, using nine moulding machines, some of which have a capacity for a 10x16 bed-plate or an 18x24 cylinder, and will produce 15,000 pounds of castings each per day. The two melting cupolas have a capacity of 60 tons each per day, from which concentrates an overhead track and switch system that will carry a load of 10,000 pounds to any part of the floor, and is also arranged for carrying weights from any point, and the system is so perfect the labor of 18 to 20 men is saved in pouring off alone. There are three traveling cranes in the west wing of the foundry, two having 7 tons and one 9 tons capacity. The area of the foundry floors are 50x270 and 50x345 feet respectively in both wings.

The machine shop is divided into two branches, one for side-crank en-

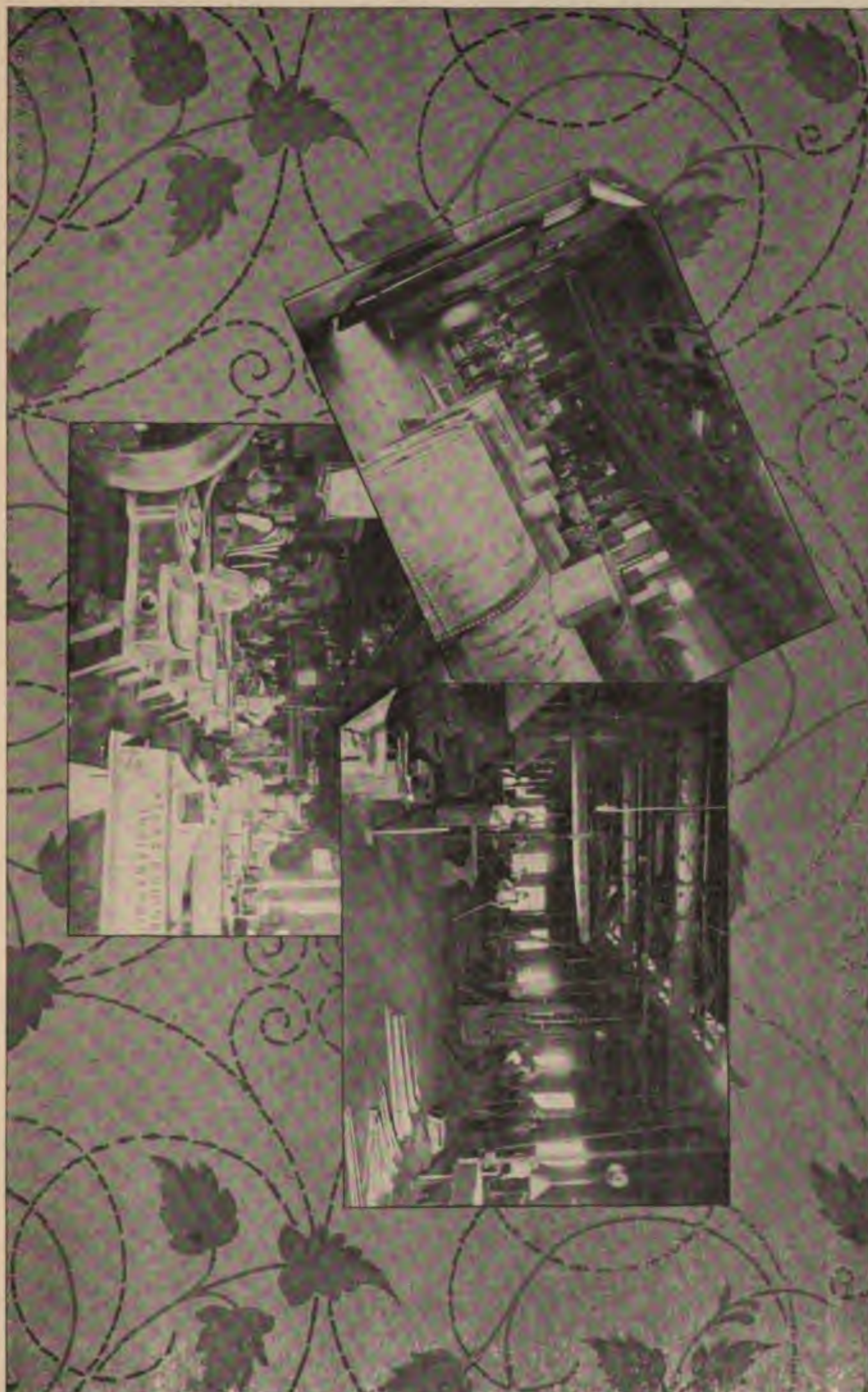
gines, plain and automatic, and the other for the self-contained engines, plain and automatic. These are again divided into a construction and an erecting branch. The first named employs 150 men and 85 machine tools, as lathes, planers, boring mills, milling machines and drill presses. All of these contain the latest improvements, and several types have been especially constructed by this company for their special work. Many of these tools are of ponderous size, as would be imperative in the working of the parts of their large engines. One that is now in course of erection for the world's fair, is a tandem compound engine of 500 horse power, and a feature in this which is worthy of mention is the distance piece separating the two cylinders, which admits the head of the low pressure cylinder to be taken off without disturbing the adjustment and alignment of either cylinder. Another feature is the use of a cast metal bushing in the high pressure cylinder, that in cases where a cylinder is liable to get cut, the bushing can be withdrawn and a new one inserted, thus prolonging the life of the engine and securing uniform effectiveness in power.

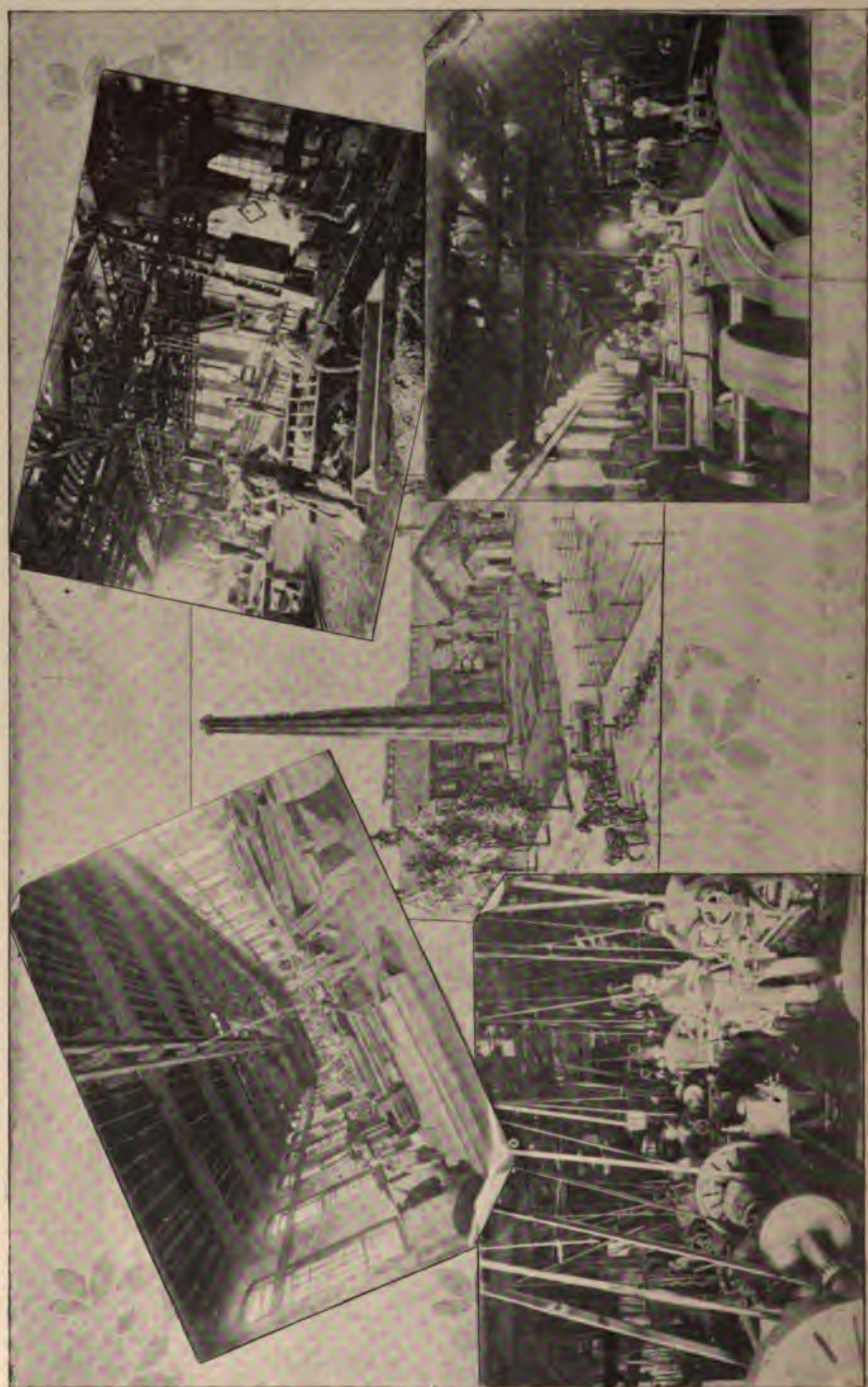
All parts of their engines are made on the interchangeable system, and worn out or injured parts can be substituted in a few moments. The main bearing which usually is constructed as a part of the bed-plate, is made removable on the Atlas engine so that in case of accident, if the bearings get overheated and the babbitt melted, a new one can be instantly inserted. This department, as well as all the others, has a system of overhead tracks for elevating and carrying, operated by compressed air. The department for self-contained engines employs 65 men. with 52 machine tools, and the same system is used as in the other.

The blacksmith shop employs 30 men and contains 13 forges, and 15 furnaces for heating and forging connecting rods; also punching and shearing machines capable of shearing and punching steel 1¼ inch thick; also two steam hammers. Forging of standard work is done with special dies, insuring exact uniformity, and enabling all work to be made solid from the bar, without welding.

The boiler shop employs upwards of 100 men, and is fitted with every appliance for bending, shearing, punching and riveting steel plates up to ¾ inch thick and 62 inches wide. The flanges on boiler fronts, steam domes, etc., are cut and pressed into form on a hydraulic press with a capacity for one million pounds. The capacity of this department is for six boilers daily of 55 horse power each. Mild open hearth steel of 60,000 pounds tensile strength is the grade used exclusively.

Aside from the erecting shops connected with the two machine departments above noticed, there is an additional erecting shop for small engines 52x150 in area, where 74 were on the floor in various degrees of completion. This department employs 75 men, all bench and floor hands. Near this is





a store or shipping room, where it is the aim to keep 20 of each of the 17 sizes of engines made, on hand to meet the general demand. When the illustration was photographed 100 were in the room awaiting shipment. An idea of theextensiveness of this trade may be seen in the fact that as high as 24 boilers and engines have been shipped in a single day.

The yards are crowded with completed boilers, pig-iron, boiler plates and tubes and a line of raw materials. Switches run in every direction, the hauling being done by a locomotive of their own manufacture. The yard force averages 55 men.

Besides the Atlas-Corliss engine that is the main source of power, several of the high speed automatic type are used in various portions of the works. The power-house is a plant in itself, and the fuel source here, as well as in the blacksmith shop and elsewhere where it can be utilized, is natural gas. Light is supplied by an electric plant.

This description is necessarily only the briefest outline, for even cursory details would require a volume to explain, but it will afford an idea of the nature of this business that in fourteen years has grown notorious amid the steam engine industries of the world.

RECIPROCITY WITH COLOMBIA.

A RECIPROCITY agreement has been negotiated with the republic of Colombia, according to late advices from Washington. Colombia, as will be remembered, was one of the countries against which retaliatory duties on sugar, molasses, coffee, tea and hides were imposed by proclamation of the president, owing to failure to enter into reciprocal trade arrangements within the time limited. The negotiation of the treaty at this time is reported to be due to the accession to the vice-presidency of the state, which is really the acting presidency because of the invalidism of the President, of a man favorable to reciprocity relations with the United States, which were opposed by the former minister of foreign affairs.—*Bradstreets*.

PHINEAS BOGGS: HOODOO.

MY semi-attachment to a New York newspaper as reporter keeps me constantly on watch for things to write about, for I am "on space," not on salary. So I saw a ray of hope in this advertisement in the *Herald* one morning:

Phineas Boggs: Professional Hoodoo. 687 West Fifth street. Office hours 9 to 12.

A hoodoo, in the slang of the commoners, is a person who brings bad luck. I knew that well enough. But what was a professional hoodoo? If, by rare fortune, the *Herald* people had overlooked this singular announcement—and I had heard of newspaper men who did not read their own papers—the hoodoo was my prey for a remunerative interview. Hm! Eight o'clock. Just time enough to finish breakfast and be there when his office opened. The elevated road was at my door (a circumstance that commonly gave me no pleasure) and after climbing up it I was whirled down to West Fifth street where number 687 shortly disclosed itself as a two-story brick house with an iron fence defending an "airy," and Ionic pilasters supporting a meager pediment at the door; marks of gentility attaching to an earlier generation. It was just such a dull and faded neighborhood as a hoodoo might like to live in. A ring at the bell conjured forth a lean and weak-voiced man of forty or so, whose watery gray eyes squinted to such an extent that he seemed when in contemplation, to regard with displeasure the end of his own nose—an organ that, being ample, was the most distinguished feature that he possessed, for his brow was narrow and bulbous, his mouth thin, his chin small, his hair of the color of wet straw and of moth-eaten appearance, while his attitude and expression betokened habitual sadness. I inquired for Mr. Boggs.

"I am Mr. Boggs, sir," he answered.

"I saw your advertisement this morning, and—"

"Ah, yes, yes. Come in." And he led the way to a parlor furnished with the black walnut, hair cloth and tapestry carpet of thirty years ago, and made additionally mournful by two vases of paper flowers, six stern, reproachful photographs and closed blinds.

"I suppose it is races. Isn't it?" he asked, as he lowered himself cautiously into a rocking chair and motioned me to a sofa.

"Well—ah—that is, I would first like to know how you operate," I replied, glad to escape a plump question as to my business.

"Oh I suppose perhaps you don't know what a hoodoo is; leastwise, a professional one. Of course, there's hoodoos enough. Maybe you're one yourself. No? Well, I guess I'm the first to go into it as a trade."

"How did you happen to do it?"

"You see, when I was a boy I never had any luck and never had any fun. Everything went wrong with me. Likely my name was against me. I don't like it myself. I used to get licked by the teachers and then I got licked at home for getting licked at school. If I went fishing I caught nothing but colds, and sometimes not even them. I could go for a week without coughing or sneezing, but let me into a funeral or a meeting and I'd cackle and bark most enough to break it up. When I was seventeen I wanted to be a carpenter. No use. Couldn't drive a nail, nor plane a board straight, nor get an augur hole true. I lost this finger with a chisel and two toes trying to use an adze."

"That was hard."

"Yes, spoiled the adze, too. Then I undertook to clerk it in a grocery, but after I'd sold twine for cider, and charged a woman a dollar for a pound of lard, and got hit behind the ear, where this knot is, for sending a demijohn to a man's house instead of to his office, the boss told me I might as well quit, and I went to undertaking. I don't see how it could be, yet every time I got a patient his coffin didn't fit him, or the top wouldn't go on, and once, after I had put the name of a relative, who had ordered a casket, on the plate, in place of the name of the man who was inside, and had the hearse driven to the wrong plot, I was advised to study some other profession."

"Like medicine," I suggested maliciously. "Then you could have kept an interest in the undertaking business."

He pondered for a minute, then said, "I declare, I hadn't thought of that. It will keep. You see, I didn't study any more. I scratched a few dollars together—only a few, because my friends were short of money—and went to the races."

"And being a beginner, you—"

"Lost every cent and walked home, twelve miles. Next morning I managed to collect a few dollars more and went back. Same thing happened, only I saved a dollar to ride home with. But a new idea came to me that day: Why shouldn't I realize on my luck? It was useless to conceal the fact any longer that I was a hoodoo. Why not make the best of it? I went to bed light-hearted, although I remember that we had pie for supper, and next morning I was off again for the races. There was a man there who had put a thousand dollars on Jimuel H. Hopkins, and when he heard my story he handed over five dollars, which he begged me to 'put' on P. Q., that being the only horse that Jimuel H. Hopkins had cause to fear. I bet

on P. Q., and he came creeping in, the very last one in the procession. The man shook hands with me cordially and hurried away to his friends. Then I went to a young fellow who had put almost everything he owned on Game Legged Tobias, and offered to bring that horse in if he had money enough left to enable me to bet against all the others in the field. He had just enough. I laid it out on the other horses and watched the young man trembling as the racers went around the track. He had no cause to tremble. My betting on the others had struck them with a spavin, and Game Legged Tobias came ambling in ten rods ahead. He went down to cash his tickets, and I didn't see him again. He had forgotten that I was the hoodoo. So had I."

"You can take it out by betting on the same horse that he does, next time you meet him."

"No, it was merely fate. After that I only bet for cash in advance, including the price of pool tickets. Sometimes there were so many applicants for my services that I could have had bets on all the horses at the track, but that would have been unprofessional and unfair. It was necessary to let one horse in, or the show would have been broken up."

"You must have made money."

"I did. When the Bullgammon Bank busted last week I had sixty-five dollars in it. But the races don't pay now. As soon as it was known that I was a hoodoo I began to be regarded with suspicion, and last Saturday the owner of a horse that I had bet on met me after the race. It has been necessary for me to use a cushion in this chair since. There are other race courses, though, and there are some things that I have not had a chance to try, that ought to bring a good living. For instance, I can go to a new play and kick up a row and hiss, and that will be the making of the play. Then if I could notice books for some newspaper I could draw a good income from authors for running them down and making them wealthy. I will rent my vote to political parties, for by voting for an opposing candidate I can blast his future. I might be useful in Wall street. But I beg your pardon. I have kept you from stating your business."

"I am a reporter," I said.

"And you don't want anything on the races?"

"Not to-day, thanks. I only wanted an interview."

Mr. Boggs turned in his chair and rested his head wearily on the back of it. "I didn't lock the front door," said he.

"Thank you," I replied, and started toward it.

"Oh, say!" he resumed, suddenly. "Would you mind doing me a favor?'

"I would be glad to," I answered.

'You see—ah—the fact is, I—er—in short, have not had my breakfast. No. I spent all the money I had, except a quarter, in putting an advertise-

ment into the paper. Now, if you would be so kind as to bet me a quarter that Mr. Schmittberg, who keeps the eating house on Eighth avenue, will trust me for a breakfast, that will enable me to bet that he won't. Then he will."

"Certainly," I said. "Who will hold the stakes?"

"Oh, there is no need of getting anybody to hold them. We can put them on the mantelpiece. There's mine. And there's yours. Much obliged."

"You're welcome. Good morning."

I went down to the newspaper office and wrote a column about Mr. Boggs. But his blight was upon me, for that day. The article was not accepted.

C. S. Montgomery.

WAGES IN EUROPE.

BLACKSMITHS receive $9.62 per week in England, $4 in Germany, $5.81 in France, $5.38 in Belgium, $3.18 in Austria. Carpenters receive $9.75 in England, $4.11 in Germany, $6.20 in France, $4.07 in Belgium, $5.10 in Austria. Cabinet makers receive $6.22 per week in England, $4.25 in Germany, $6.14 in France, $5.66 in Belgium, and $4.40 in Austria. Machinists receive $9 per week in England and $4.60 in Germany—no figures at hand for France, Belgium and Austria. Painters receive $8.92 per week in England, and $4.82 in Germany—no figures as to other countries. Machinists, $7.19 weekly in Great Britain and $4.60 in Germany. Laborers, $5.29 per week in England, $3.11 in Germany, $3.93 in France, $3.77 in Belgium and $3 in Austria. Printers are paid twenty cents per 1,000 ems in England, and receive $6.64 per week in France, $5.94 in Belgium and $3.95 in Austria; bricklayers, $7.75 per week in England, $4.21 in Germany, $5.74 in France, $4,56 in Belgium and $3.55 in Austria; masons, $8 per week in England, $4.07 in Germany, $5.33 in France, $5.22 in Belgium and $3.73 in Austria; farm laborers $3 per week in England, $3.06 in Germany, $3.10 in France, $2.72 in Belgium and $3.50 in Austria; coopers, $6 in England, $3.97 in Germany, $5.58 in France, $5.17 in Belgium and $3.64 in Austria; shoemakers, $6 per week in England, $2.95 in Germany and $2.90 in France.—*Report of the Bureau of Labor Statistics*

POINTS IN STACK CONSTRUCTION.

MR. F. FELKEL, architect and consulting engineer, of Cleveland, has prepared plans for the Garford Manufacturing Co.'s plant, about to be built at Elyria, O. The main building is 40'x100', and three stories high, of 15' each and has a half-basement 12' in height. The boiler and engine house is 33'x39'x20' with a stack 90' in height, above ground. The buildings are designed according to slow-burning mill construction, with brick walls and the elevations make a sightly appearance. Provision is made for ample light, good ventilation, heating by hot blast apparatus, electric light and for modern factory plumbing on all floors.

The specifications for the stack of this structure have been prepared by Mr. Felkel with special care. While there are a number of theoretical treatises on stack building, the practice depends greatly upon the surroundings and the location. From the static view point, many stacks planned by theorists are too weak, especially while they are in course of erection, before the mortar has bound up. Furthermore, stack building is always attended with risk and requires the closest supervision. A few points in the specifications for the stack of above plant are given below: For foundation there will be a concrete block, 12'x12'x24" at bottom; concrete to be made of one part Portland cement, three parts clean sharp sand and five parts of broken stones, sizes not larger than will pass through a two-inch mesh—all to be thoroughly mixed. On top of this concrete, two courses of footing stone, each course consisting of two pieces 5'x10'x16," with the joints in opposite directions.

CUT STONE.—There will be a rock-face course of water-table at ground, 6"x14" with a 2"x½" wash on top, to be on three sides only. At the height of the third-story window sills will be placed a rock-face course 11½"x13" with a 5"x3" wash on top, to be on three sides only. Where the stack goes from square to octagon (51' above ground on floor) a cap stone will be placed all around, 14" thick by 17" wide, with a 10"x4" wash on top. On top of this cap course will come the octagon cut stone for the formation of the octagon stack. The last two stones mentioned to be crandled.

BRICK.—The inner 8" wall beginning 12' above floor line up to 51' above floor line to be laid up with Sheppard fire brick; the facing and the inner rollock of bridging entrance to be fire-brick. All to be laid in best fire clay mixed with lime mortar, with full joints. All other walls to be built of common hard-burned brick, laid up in lime mortar tempered with cement. As many air holes shall be left as may be necessary, each hole shall be no larger than the thickness of one brick. The recess for the connection of the walls of the building shall be 8" wide by 4" deep and shall reach the full height up to eave line, so that the stack stands independent of the building.

The corner of octagon on outside to be built with octagon brick. Bridging entrance to be built elliptical 3′ 6″x6′ 6,″ with three 4″ rollocks around it clear through the wall.

IRON.—In the center of the concrete block in foundation, place eight 4″ I. B. (7.5 pounds to the foot) 11′ long; all to be bolted together at each intersection with two 5-8″ bolts through the flanges. The bridging entrance shall be tied with two sets of I beams; each set to consist of four 6″ I. B. (13 pounds to the foot) 9′ 6″ long (two on each side) connected with an 8″x¼″x9′-6″ plate, and another plate 4″x¼″x8″ at the rods; all to be well riveted on to I beams. Rods at top and bottom to be 1½″ diameter, with nuts and washers. The cap of stack shall be cast iron, made in four pieces, with ribs as shown and bolted together at each joint with two ¾″ bolts; cast iron to be 1½″ thick. There shall be one stack-cleaning door and frame of heavy pattern (Buttman pattern) 20″x36″ with semi-circular head.—*Iron Trade Review.*

THE EARLIEST BANK NOTES.

THE earliest issue of bank notes, so far as known, was in that coun t of antiquities, the Chinese empire. As far back as B. C. 2697 the Chinese treasury issued bank notes, some of which are still in existence. The treasury then did a banking busines, which, however, it soon turned over to private enterprise, the Chinese banks being then as now under government supervision and control. So far as essential particulars were concerned the notes issued at that remote date did not differ in any material respect from those of to-day, each bearing the name of the bank, the value of the note, the place of issue, the date and signature of the bank officers. The Chinese called the bank-notes "flying money," and regarded them as superior to the precious metals on account of the greater facility of handling. Many of these early notes are still in existence and may be seen in various European museums.—*Exchange.*

NO MISTAKE ABOUT IT.

"WE have long regarded STONE as the leading trade magazine in the stone, marble and granite interest."—*Northern Granite Co., St. Cloud, Minn.*

PREHISTORIC REMAINS ON EASTER ISLAND.

AN account appears, by Paymaster Thomson, of the United States Navy, in the report of the United States National Museum, of an investigation which he made into the antiquities on Easter Island. It is probable that the island was at one time densely populated, and the remaining monuments show that the inhabitants had attained a higher degree of civilization than other Polynesians. As to the famous stone images of Easter Island, Mr. Thomson counted every one there and found that they numbered 555. Of these 40 stand inside the crater and nearly as many more on the outside of Rana Roraka at the foot of the slope, where they were placed for removal to the different slopes for which they were designed. Some lie scattered over the plains as if they were suddenly abandoned when being dragged to a particular locality. The majority, however, lie near platforms all round the coast all more or less mutilated, and some reduced to a mere shapeless fragment. Not one stands in its original position upon a platform. The largest was found in one of the workshops in an unfinished state, and is 70 feet in length; the smallest was found in a cave and is less than 3 feet long. One image of 32 feet in length weighs 50 tons. The natives have names for every one of the images; the material is a coarse, grey trachytic lava, which was amenable to the coarse stone tools of the people. Though varying in size, the images are all of the same type. The head is long, the eyes close under heavy brows, the nose long, low-bridged and expanded at the nostrils, the upper lip short and both lips pouting. The expression is firm and profoundly solemn. Mr. Thomson thinks they were designed as effigies of distinguished persons, and were intended as monuments to preserve their memory. They were never regarded as idols, and were not worshiped. The native deities were represented by small wooden or stone idols. The image-makers were a privileged class, and the profession descended from father to son; some of the natives still claim with pride descent from them. The image was carved in rock, and the difficulty was to convey it to its destination. It was lowered from the mountain by a system of chocks and wedges. A roadway was then constructed along which it was dragged by ropes made of hemp, while seaweed and grass were used as lubricants. The platforms were all built with sloping terraces in the rear, up which the image was dragged until the base was over its resting place, when the earth was dug away to allow the statue to settle down, ropes being used to steady it in the meantime. The incised tablets which are also found show that the natives had evolved a system of writing. These tablets are highly prized by the people, and it was with the utmost difficulty that Mr. Thomson was able to purchase two.

It is said that a large number were destroyed at the request of the missionaries, so that the people should have as little as possible to attach them to

Paganism. The meaning of the characters has been quite lost, and Mr. Thomson suggests that it is probably due to the kidnaping in 1864 of every person of learning and authority in the island. The pictorial symbols are engraved in regular lines on depressed channels, separated by slight ridges intended to protect the hieroglyphics from injury by rubbing. They cover both sides as well as the beveled edges and hollows of the board. They are alternately reversed on each line, those on the first standing upright, on the next upside down, and so in regular alternation, so that the reader must turn the tablet at the end of each line. The reading commences at the lower left-hand corner, and on arriving at the top of the first face, or the opposite corner, the reading is continued over the edge to the nearest line at the top of the other side. This method is supposed to have been adopted to avoid the possibility of missing a line. A patriarchal native, on being shown photographs of the tablets, related the legend appropriate to each. Mr. Thomson intimates that he will subsequently treat these symbols exhaustively.

PUMICE STONE.

WE often hear it remarked, and particularly after the eruption of a volcano, that pumice stone ought to be plentiful and cheap, as quantities must have been ejected during the volcanic disturbance. As a matter of fact, however, none of the white stone in general use is obtained from active volcanos. It comes from deposits of the article discovered in one or two quarters of the globe, the best of which is at present to be found in the island of Lipari, situated in the Tyrrhenian sea. The island is mountainous in character and consists of tuffa and lavas and highly silicious volcanic products. The district where the stone is found is called Campo Blanco or Monte Petalo, 1,500 feet above the level of the sea. After riding a considerable distance, partly along precipitous paths sufficiently dangerous to be interesting, and partly through vineyards and over grassy plains, one almost suddenly comes upon a seemingly snowclad narrow valley, inclosed by hills, also quite white, and the whole glaringly bright on a sunny day. Into these hills workmen are ceaselessly digging deep burrows, working within by candle-light. In their excavations they come across many lamps of pumice stone, which are placed in baskets, subsequently being conveyed along the valley to the seashore, where small boats are loaded and sailed to the seaport near by, where the stone is sorted, packed and shipped to distant parts, either via Messina or Leghorn.—*Builder and Woodworker.* *F*

A REMARKABLE STONE.

ON the outskirts of the modern village of Baalbek attention is arrested by the quarries whence the stones of Baalbek were hewn, and which lies on the right hand of the road from Shtaura. In the midst of these quarries there lies one stone, hewn and fashioned with exqusite accuracy, almost severed from the solid rock, and apparently waiting to be carried away to its destined place in the walls of the great Phœnician Temple of Baal. There it has remained in silent grandeur for upwards, probably of 3,000 years, suggesting to the thoughtful observer many interesting and curious reflections. How long was that stone in process of excavation and fashioning? How many human hands were employed upon the work? What implements were used for the gigantic toil? How was it to have been removed from the quarry to its appointed place? How raised to its position when once carried there? Why, after all the labor which had been bestowed upon it, was it left at last in the quarries? Could we discover the answer to this last question, we should probably learn of some great crisis in the world's history, some mighty incursion, some decisive battle, some irrevocable overthrow of a powerful nation. For it is evident that the work was abandoned suddenly, while yet remaining in an incomplete condition; and there is no explanation so feasible or probable as that of conquest by a foreign foe. But how shall we exhibit to the reader the marvelous proportions of this colossal stone? Roughly speaking, and in round figures, we may say that it is seventy feet broad, and fourteen feet high. Now what does this mean? Imagine a room fourteen feet square and seven feet high—a very fair sized cottage room. Imagine a house with ten such rooms in it, five on the ground floor in a row, and five on the first floor above. Imagine this house to be one solid block of stone—and we have the stone in the Baalbek quarry! It has been computed to weigh at least 1,500 tons; and a further calculation has been made that it would require 40,000 strong men, pulling their hardest in the same direction, to move that stone a quarter of an inch in an hour!—*Macmillan's Magazine.*

A MIGHTY SAW.

A ONE HUNDRED and ten ton saw is calculated to cut through almost anything, even through a nickel-steel armor plate; and for just this use has the gigantic saw been made for the Homestead mill, Pittsburg, at a cost of $35,000. The blade of the saw is 7½ feet in diameter, being geared from above and revolving horizontally. After one has gazed upon this huge steel carpenter'stool, he little wonders to see it slice off an angular slab of cold nickel-steel, weighing about a dozen tons, as easily as a carving-knife clips off a crisp turkey wing.—*Philadelphia Record.*

WHETSTONES IN THE UNITED STATES.*

THE record of the manufacture of whetstones in the United States is meager. The earliest published item found is that novaculite quarried at Oley, Berks county, Pa., was selling in 1822 for 25 cents per pound. In 1822 also two quarries of oilstone on Lake Memphremagog were reported to have yielded profits exceeding $5,000 for the two preceding years. The geology of Massachusetts, published in 1835, states that over five thousand dozens of whetstones were quarried annually in Smithfield. The geology of Rhode Island in 1840 reports the production of the same quarries at from six to eight thousand dozens. Twenty-two thousand eight hundred were manufactured in Bellingham, Mass., in 1838. These figures show that there was a pretty active whetstone industry in New England at this time, particularly when it is considered that whetstones were also being manufactured in New Hampshire, Vermont, Pennsylvania, North Carolina and Arkansas at the same time. Possibly the business was overdone at the time and a reaction followed, for the Massachusetts and Rhode Island quarries are not heard of after 1841, and nothing is heard from the Pennsylvania quarries until new ones were reported in 1883. The industry has been a constant one since 1840 in New Hampshire, Vermont and Arkansas, and also in Indiana, where the Hindostan quarries were opened about 1840; though in all these localities quarries have been abandoned and new ones opened during the intervening years. In North Carolina also it is presumed that the manufacture has been fairly constant; the stone is not known in the northern market, so the demand is probably a local one. Exactly when the Berea grit of Ohio came into use for scythestones has not been learned, but its use for this purpose is reported in the Geological Survey Report on Economic Geology, 1873. Only a small part of the grit is suitable for use, so the whetstone manufacture can only be carried on in connection with production of stone for other purposes.

There are at the present time in the United States the following old established localities for quarrying whetstones: New Hampshire, Vermont, North Carolina, Ohio, Indiana and Arkansas. In addition to these are more recently worked and less important localities in Alabama, Missouri, Michigan and New York. Of these the business may be considered

*From Arkansas Geological Report for 1890.

a local one ni Alabama and in North Carolina; New York and Missouri localities have more than a local business, but the product in each case is small; Ohio and Michigan furnish coarse scythe-stones only, but the quantity used is large and the industry is important. The great bulk of the whetstones come from Indiana, Arkansas, New Hampshire and Vermont. The quarries of the last two states may be considered together, since they are all controlled by one company. The New Hampshire and Vermont quarries produce stones for many purposes; scythe-stones are the chief product, but carpenters' whetstones, axe-stones and small stones for other purposes are also produced. In Indiana two stones are quarried, one a shoemakers' sandstone and the other a very fine-grained, compact sandstone, used chiefly for whetstones by carpenters, mechanics and others. Arkansas produces two varieties of stones, the "Ouchita," a fine quality of carpenter's stone, and a very dense hard stone, called the "Arkansas," suitable for sharpening the smallest pointed tools, or giving a very fine edge to surgical instruments.

The New York stone is found in Cortland county on the shore of Labrador lake, from which the stone derives its name. It is a a fine-grained dark-green sandstone, occurring in beds two or three feet thick, interbedded with shales from two to six feet thick. The formation lies in a nearly horizontal position and is about five hundred feet in thickness. It is tough and sharp-gritted, but feels coarse compared with Turkey or Arkansas grit. The toughness of this stone, due to the presence of the limonite cement, makes it a valuable one where strength is a necessary quality; thus it is particularly well adapted for kitchen stones and for the coarser kinds of files. This stone is not very well known yet and only about 5,000 pounds are manufactured annually.

Its manufacture was begun ten years ago at Manlius Station, with two small saw-gangs and a rub-wheel. Other kinds of stones have since been used and the business increased until now there are nine saw-gangs and three rub-wheels running constantly. Hindostan and Turkey stones are sawed at this factory to some extent; stone from Arkansas has been manufactured here and forms a very large part of the whole product. The sand used in sawing is fine and very purely siliceous, consisting of angular, subangular and well-rounded quartz grains frequently iron-stained. The average diameter of the grains is about .20mm.

The whetstone factory at Pierce City, Mo., is a small one containing one large saw-gang, a rub-wheel and a finishing wheel. The finishing wheel is simply a two-foot disk covered with sand-paper on which it is claimed a better finish is obtained than on the rub-wheel. This may be a good method to finish a soft stone like the Adamascobite grit which is manufactured here, but it probably would not be so successful if used with harder stones.

The sawing sand used comes from Pacific, Mo., and is fine and white. The stone is compact and heavy, has a dull, yellow color, and resembles closely some varieties of Hindostan stone, but is softer and finer grained and has a velvety feeling. The microscope shows that the grains of the silica are about .02mm. in diameter. Mingled with the silica is a large amount of muscovite mica, earthy matter and iron. The soft feeling is probably due to the muscovite present. The whetstones manufactured here are good for those who like a fast cutting stone. They make excellent rub-stones also for marble polishers. They have not been put on the market in large quantity, but have been sold in small lots at 50 c. to 65 c.per pound.

Since the manufacture in New Hampshire and Vermont is controlled by the Pike Manufacturing Company, and since their product is so similar, the two are considered together. In Grafton county, N. H., the company works four quarries. The schists in these quarries lie in "rifts" of different lengths and widths. The sheets are cut up or "bolted" into slabs about ten and one-half by twelve inches long by two to four inches thick. These slabs are then marked and broken into rough stones about two inches wide by means of steel knives and hammers. The rough stones are ground into the finished form on a horizontal rubbing bed fed with sand and water. The grinding is done at Pike Station. The stone manufactured here is the Indian Pond scythe-stone. The chocolate stone, quarried at Lisbon, is a finer grained than the Indian Pond stone, and is made into oilstones, knife-stones, or fine scythe-stones. From 10 to 15 tons are produced annually. The chocolate stone is not finished by the Pike Manufacturing Company, but the manufacture is carried on by contract with the Lisbon parties.

In Vermont the stone is finer grained, more compact, and a little harder than the Indian Pond stone. Owing to these differences in character, the Vermont stone is sawed into slabs instead of being cut or broken, but they are finished in the same manner as the Indian Pond. At the works in Evansville 4,000 to 7,000 gross of scythe-stone are manufactured annually. The principal brands of Vermont stone are the "Black Diamond," "Lamoille," "Willoughby Lake" and "Green Mountain." These stones are exported only in small quantities, though of the Indian Pond 5,000 gross or more go abroad every year. The same company owns quarries in Cummington, Mass., the stone of which resembles the Vermont stone closely, but it is a little harder and more liable to glaze.

The manufacture of sandstone scythe-stones in Ohio and Michigan is controlled by a single company, the Cleveland Stone Company, and the productions of these two states may therefore be considered together. The Cleveland Stone Company is the strongest organization in the whetstone business at present, though the whetstone industry, however, forms but a small part of its whole business. It owns a large amount of stock of the

Pike Manufacturing Company, and so influences the production of mica schist stones in New Hampshire and Vermont, and also the manufacture of whetstones from Arkansas. It also has absolute control over the sandstone scythe-stone industry in this country.

The quarries of the Cleveland Stone Company in Ohio are located at Berea, Cuyahoga county; those in Michigan, are at Grindstone City in Huron county. Nine-tenths of the total product is manufactured in Michigan. The method of manufacture consists in sawing the blocks of stone into slabs, which are broken into the required length and then given the slender form of the scythe-stone by breaking again under a knife or "guillotine." The rough strips thus formed are rubbed down on a wheel made of basswood filled with iron scraps driven in edgewise. The wood wears away faster than the iron, so that the projecting edges, with the assistance of sand and water, wear away the stones more rapidly than a smooth rub-wheel would do. The total product is about 8,000 gross per annum, of which about 1,500 gross are exported. The stones are worth on the average $3.50 per gross.

The whetstone quarried in Orange county, Indiana, is a fine-grained sandstone. The microscope shows it to contain much earthy material and limonite, with a little muscovite mica. The grains of silica are about .02mm. in diameter and are remarkably uniform in size. There are a few shapeless cavities in the stone. The limonite probably forms the cementing substance in this stone, as in the Labrador stone, though it is not so strong; it is stronger, however, than that of the Adamscobite grit, so this stone lies between the other two in hardness. The Indiana whetstones are known in the market by the name of Hindostan; a variety having a buff color goes by the name of Orange stone, while the finest grade of white stones are called "Washita finish." Most of the stone has a dull gray or yellowish color. Some of its micaceous, and thin micaceous layers and laminæ of iron ore afford convenient seams along which it is split in quarrying and working. There is considerable variation in hardness among the Hindostan stones coming from different strata.

The natural advantages for working the Hindostan stone are very great. It is found in a nearly horizontal strata, interbedded with shales and some other strata not suitable for whetstones. The different quarries show considerable variation in the thickness and character of the beds worked, but in all a thin coal seam marks the lower limit of the good stone. The amount of cap rock to be removed is usually small, and a large percentage of the rock quarried is suitable for whetstones. Some stone not good for whetstone, is used for flagging. The good stone is wedged up in sheets, frequently of just the proper thickness for use; when not of the right thickness the slabs are easily split along the stratification planes. The

thin sheets of stone are ruled off into the desired sizes, and the lines are deeply marked by a scribing awl. The sheet is then turned over, marked lightly, and then with a broad-edged stone chisel and hammer the whetstones are broken out in rough form. Rubbing down on a wheel finishes them. This is the greater part of the work, but cheap labor is employed, women, girls and boys attending the wheels. Some of the harder and more massive rocks are shipped in blocks to the manufactories in New York, and at New Albany, Indiana, where they are sawed. About 400,000 pounds of Hindostan stone was put on the market in 1886, 100,000 of which was exported. Later reports do not show much change in production, though it has probably increased slightly. The prices in 1886 were considerably higher than they are now, ranging from three and one-half to six cents per pound; at present a very great part of the stone is sold at one and one-fourth to two cents per pound, with higher prices up to ten cents per pound for special orders of selected stone. These stones are excellent to produce a rather coarse edge; they are much used by English cutlery manfacturers to give the first rough edge before the knife-blade receives its final polish. Their export increases annually.

The manufacturers of Hindostan stone are J. A. Chaillaux and Kirk & Pruett, at Orangeville, T. N. Baxton, and William F. Osborn, of Paoli, and Brown Moore, of French Licks. Of these, J. A. Chaillaux is the only one engaged in the whetstone business exclusively. T. N. Baxton and William F. Osborn are merchants who operate quarries. Brown Moore and Kirk & Pruett are farmers who have quarries on their land. At retail the stones command a good price, and in hundred pound cases are quoted at from six cents to thirty cents per pound. Many of the Hindostan stones are beautifully marked with mineral stains. Some of these of fine quality have the special brand of Niagara stones, and are quoted at 25 to 40 cents a pound in small lots. The Hindostan stones are commonly used with water, though oil is sometimes used with the finer grades. The other variety of Indiana stone from which shoemakers' sandstones and glass manufacturers' files are made, is a porous, friable sandstone much coarser than the Hindostan and belonging to the different series of strata. It is more easily worked than the Hindostan; it is sawed by a saw-gang run by horse-power, and the rubbing part of the process is rapidly done by hand on a large block of the same stone. The stones are made in prismatic form one and a half inches on a face and from ten to twelve inches in length. About the same amount of this stone is put on the market annually as of the Hindostan, and about the same proportion of the total product is exported. The price given in 1886 was four cents per pound, but was only one cent in 1890. These stones are quarried by the farmers at dull seasons of the year and traded to the merchants for goods. There are as many as six quarries

in the vicinity of French Licks, probably more. The other American stones manufactured in large quantity are the two varieties found in Arkansas.—*L. S. Griswold.*

STANDARD TIME.

PRIMARILY for the convenience of the railroads, a standard of time was established by mutual agreement in 1883, by which trains are run and local time regulated. According to this system, the United States, extending from 65° to 125° west longitude, is divided into four time sections, each of 15° longitude, exactly equivalent to one hour. The first (eastern) section includes all territory between the Atlantic coast and an irregular line drawn from Detroit to Charleston, S. C., the latter being its most southern point. The second (central) section includes all the territory between the last-named line from Bismarck, N. D., to the mouth of the Rio Grande. The third (mountain) section includes all territory between the last-named line and nearly the western borders of Idaho, Utah and Arizona. The fourth (Pacific) section covers the rest of the country to the Pacific coast. Standard time is uniform inside of each of these sections, and the time of each section differs from the next to it by exactly one hour. Thus, at 12 noon in New York city (eastern time), the time at Chicago (central time) is 11 o'clock a. m.; at Denver (mountain time), 10 o'clock a. m.; and at San Francisco (Pacific time), 9 o'clock a. m. Standard time is 16 minutes slower in Boston than true local time, 3 minutes slower at New York, 8 minutes faster at Washington, 19 minutes faster at Charleston, 28 minutes slower at Detroit, 18 minutes faster at Kansas City, 10 minutes slower at Chicago, 1 minute faster at St. Louis, 28 minutes faster at Salt Lake City and 10 minutes faster at San Francisco.

TIDES.

"THERE is a tide in the affairs of men, which, taken at the flood, leads on to fortune."

We need not refer to Washington, Napoleon, Jackson, Lincoln, Grant or other great historical figures, who, though not born great, yet achieved greatness by force of circumstances, or, as put in the language of Brutus, by taking the tide at the flood.

Of course it is not always that we can know the state of the tide, and in fact, are mostly governed by the drift of circumstances, but in looking backward we can see that our lives are shaped by surroundings and their course changed by slight events, not at the moment recognized as flood-tide in our affairs. Nor is the "fortune" referred to necessarily stocks, bonds and bank accounts, but may mean simply honorable, respected or contented positions of many kinds, fully as satisfying as mere wealth—though that seems now to be the common definition of "fortune."

You all know the barefooted country boy, the prototype of Tom Sawyer, who, emancipated from the log school-house, at the age of fourteen, attracted the attention of the storekeeper, was taken on as clerk on a picayunish salary, with ample and expanding self-confidence backed by industry, honesty and the desire to please, develop ambition which in a few years wafts him to the city, where he rises step by step to leading and respectable positions, with or without wealth, but in any case looking backward scarcely able to realize how the changes have come upon him.

You see a simple country girl dissatisfied with her narrow surroundings, wend her way to the city where, by chance, she becomes a hotel waitress instead of going into a factory; she is efficient, handsome, marries the proprietor, who becomes rich, probably through her help; he retires at an opportune time leaving her a blooming widow. She shines as a leader of the "four hundred," goes abroad frequently, marries her daughter to a title regardless of cost—thus in her view taking the tide at the flood.

Or an attractive widow struggling for existence by keeping boarders, one of whom proposes and is accepted, afterwards strikes "pay dirt" becomes a money king and enables his wife to maintain palaces in foreign capitals where she charmingly entertains royalties of high and low degree, and marries her daughter to a prince with a lineage of a thousand years. Did she know the state of the tide, when circumstances were shaping her destiny?

We are the creatures of fate, which is only another name for circumstances,

driven by surrounding breezes though struggling ever so hard to steer our own course. Few, if any, can project a life-line in advance and follow to a given end. We can at best put earnest work on the things at hand to-day which will usually steer us to to-morrow. If we cannot thus change our circumstances we will learn to be content. Better to dig clams at the ebb than to wait idle and discontented for the flood which it may not be given to us to know when or how to take when it comes.

The slightest veering from the course might have brought the boy to any other destiny, he may be a grizzly granger earning a hard subsistence raising wheat at half price on a mortgaged farm, or he may have become the town loafer or a tramp. While the girl might have stayed at home, married and helped to run a little dairy farm, happy and contented without knowing or caring anything about the fashionable follies of the "four hundred." Or the widow may have struggled along in poverty and obscurity to the end, not even hearing of a fairy prince, much less dreaming of having the real article for a son-in-law. We may well say with Hamlet:

> "There's a divinity that shapes our ends,
> Rough hew them how we will."

Alex. H. Smith.

BALANCING PULLEYS.

WHEN balancing a pulley care must be taken that it is in "running" as well as in "standing" balance. That is, the pulley having considerable width, or being, in fact, a short cylinder, the counterbalance should always be located diametrically opposite, but on the same end of the cylinder, that the excess of weight is found. When this is not done, the tendency when running is to turn the rim of the pulley parallel with the shaft, which is really the axis of the pulley. Thus the tendency of the pulley rim is to wabble sidewise in its attempt to bring the two or more heavy points opposite each other at right angles to the shaft.

EXPRESSES APPRECIATION.

"I DESIRE to express my appreciation of the new STONE on account of the interesting and instructive reading contained therein. It is certainly superior to any publication published in its relation to subjects pertaining to the quarrymen's interests and other topics in general of much value to the building trades."—*W. N. Thornburg, Agent Cleveland Stone Co., Boston.*

STONE PRODUCTION—III.*

COLORADO.

THE stone interests of Colorado have within a comparatively few years increased to very surprising proportions. The kinds of stone now produced are granite, limestone and sandstone. The value of the stone output of this state in 1880 was only $50,400. The kinds of stone produced were sandstone and granite, the granite being valued at $41,400, while the value of the sandstone was only $9,000. The value of the stone output of Colorado in 1889 was $1,676,862. The developments are mainly due to the very much improved transportation facilities. The resources of this state are still undeveloped, and in almost all the varieties of stone produced for commercial purposes are very great.

Granite.—Ten quarries produced in 1889 an output valued at $314,673. This came from six counties of the state, named as follows, in order of value of output: Douglas, $200,049; Clear Creek, $75,000; Gunnison, $25,000; and much smaller amounts from Chaffee, Larimer and Boulder counties. The great bulk of the product was used for general building purposes, a smaller amount being devoted to monumental and cemetery uses, and a trifling quantity to street uses. The counties producing granite are all in the central part of the state, running from the extreme northern limits to about half the distance to the southern boundary. The greater portion comes from counties in the neighborhood of Denver.

Sandstone.—In 1889 there were seventy-one quarries producing sandstone, the product of which was valued at a total of $1,224,098. The product came from the following counties, named in the order of their outputs: Boulder, $405,773; El Paso, $377,800; Larimer, $317,388; Eagle, $60,000; Jefferson, $41,496; and smaller quantities from Las Animas, Fremont, Park, Huerfano and Montezuma. An amount valued at $703,477 was devoted to general building purposes. For street work the product used was valued at $509,955; the remainder was devoted to bridge, dam and railroad work. The enormous strides made in the production of sandstone are largely due to the operations of the Union Pacific Railroad company. This company not only quarried sandstone, but by the transportation facilities furnished to other quarries brought the industry to its present stage of ad-

*Report of the United States Geological Survey for 1889—90.

vancement. Colorado sandstone is now being shipped to remote points and is becoming well known to the general trade.

The following is an analysis of sandstone from a quarry in Boulder county:

ANALYSIS OF BOULDER COUNTY, COLO., SANDSTONE.	*Per cent.*
Silica	95.37
Oxide of iron	2.40
Lime	.92
Magnesia	.50
Loss by ignition	.55
Total	99.74

Among the most important sandstones of the state may be especially mentioned that known as Peachblow. This stone has met with very favorable reception and appears to be of good quality and color. It has been well received in Chicago.

Limestone.—The total value of the limestone output of 1889 was $138,091. Fifteen quarries were productive. The product came from the following counties: Jefferson, $54,950; Boulder, $36,500; Pitkin, $24,127, and smaller amounts from Fremont, Pueblo, La Plata, and Larimer counties. The value of the lime produced in this state is $91,101. For flux the amount used was valued at $35,940. The balance was used for building purposes mainly.

Marble.—Although marble has not actually been quarried for market, the prospect for the development of this industry in the near future seems to be very good. Large masses of pure white marble are to be found on Whitehouse mountain near Marble City. Preliminary steps toward development have been taken. Gunnison county also contains marble deposits varying in color from pure white to jet black. Efforts are being made to secure the investment of capital for development. The marble deposits in Pleasant valley, northwest of Fort Collins, are of great interest, and some slight work of development has been attempted. The colors found at this place are red and pearl. This marble property is about four miles from the railroad and is easily accessible by an extension of the road.

CONNECTICUT.

This state produced granite, sandstone, and limestone in 1889.

Granite.—The granite output of Connecticut was valued at $1,061,202. It came from the following counties: New Haven, $421,246; New London, $313,508; Fairfield, $188,697; Litchfield, $60,425; Middlesex, $35,341; Windham, $26,968, and smaller amounts from Hartford and Tolland counties. The product was used for the most part for building purposes. The amount devoted to this purpose was valued at $758,915; for street work, including the value of all paving blocks, $109,261; for cemetery and ornamental work an amount valued at $111,155 was produced. For bridge purposes, $65,659,

and a much smaller amount for miscellaneous uses was produced. Granite is produced in every county in the state. The most important, however, are those along the Sound coast.

Sandstone.—The total value of the Connecticut sandstone produced in 1889 was $920,061. By far the most of it came from the long known and celebrated brownstone quarries of Middlesex county. The counties in the order of the value of the product were: Middlesex, $871,476; New Haven, $40,-495, and very much smaller amounts from New London and Hartford counties. The most important quarries are in the neighborhood of Cromwell and Middletown. The work is carried on on a large scale with the use of channeling machines. Some of the quarries have gone to a considerable depth. This stone has been extensively used in the largest cities of the East for many years, and it is so well known that it is unnecessary to touch upon the subject here at any great length. The principal quarries are at Portland and Middletown, on the east bank of the Connecticut river, in Middlesex county.

Limestone.—The value of the limestone output, including the value of lime made from it, produced in this state in 1889 is $131,697. It came from Litchfield and Fairfield counties, the amounts from each being respectively $87,342 and $44,355. By far the most of the product was burned into lime the value of the lime being $129,663. The following is an analysis of limestone from the Danbury Lime company, whose quarry is in Fairfield county:

ANALYSIS OF LIMESTONE FROM FAIRFIELD COUNTY, CONN.

	Per cent.
Lime	90.00
Silica	5.83
Alumina	3.90
Magnesia	.22
Total	99.95

DELAWARE.

Granite to the value of $211,194 was taken from five quarries in New Castle county in the northeastern part of the state. An amount valued at $110,849 was devoted to bridge, dam, and railroad work, $67,202 to street work, and $32,443 general building purposes.

FLORIDA.

Sandstone, flint, and limestone are reported as existing in Marion county. The sandstone has been quarried for local use.

GEORGIA.

Within the past few years the stone interests of this state have developed to a marked extent. The kinds of stone produced in 1889 were granite, sandstone, limestone, marble, and slate.

Granite.—Of these kinds, in point of value, granite was by far the most

valuable, and it is interesting to know in this connection that while Georgia held twelfth place among the granite-producing states at the census of 1880 with a production of only $64,480 worth of granite, at the eleventh census it takes sixth place with a production of more than ten times as much, namely, $752,481 worth. This production in 1889 puts this state one place above New Hampshire, which has received the name of the "Granite State." The five states which produced more granite than Georgia in 1889 are: Massachusetts, Maine, California, Connecticut, and Rhode Island, in the order named. The granite-producing counties in the order of their importance are as follows: DeKalb, $606,075 Hancock, $68,083; Henry, $57,950, and very much smaller amounts in Bibb, Elbert, Spalding, Rockdale, Jones, Oglethorpe, and Newton. Of the total product in 1889, $347,100 worth went for building purposes, and over $250,000 worth for street work. Smaller amounts were used for cemetery and bridge and railroad purposes. Among the most important granite quarries in the state may be mentioned those conducting operations at Lithonia and Stone Mount. At these places the granite is quarried with great ease, Stone mountain being simply an uninterrupted and solid mass of granite almost entirely devoid of soil. The granite is loosened by blasting and then split by hand drills and wedges. The cheapness of unskilled labor, which is contributed entirely by negroes, together with the ease of quarrying, make it possible for operators to compete favorably with other granite-producing centers. The granite from Lithonia and Stone mountain has been quite thoroughly tested and examined by scientific authorities of high repute. The results of these examinations are very favorable to the stone.

Marble.—The value of the marble produced in Georgia in 1889 was $196,250. Of this amount, $10,000 worth came from Cherokee county, and of the remainder by far the most of the product came from Pickens county. The developments of Georgia marble have all been made within the past six years.

The following is an analysis of Pickens county marble made by Mr. John C. Jackson, of Chicago:

ANALYSIS OF PICKENS COUNTY, GEORGIA, MARBLE.

	Per cent.
Calcium carbonate	97.32
Magnesium carbonate	1.60
Silica	.62
Iron protoxide	.26
Alumina	.25
Total	100.05

It finds its chief application in wainscoting, mantels, table tops, counters, panels, etc.—in other words for purposes of interior decoration. The Georgia Marble company has a very fine plant, and the shipping facilities are

about all that could be wished. A very decided demand for this marble in most of the large cities of the Union has arisen, and seems likely to increase markedly from year to year.

Slate.—At the slate quarries at Rock Mart, Polk county, $15,330 worth of stone was produced in 1889. These slate quarries have been operated for twenty-five years. Up to 1883, the slate was all hauled a distance of twenty-three miles by wagon, and yet was sold at a profit. In 1883 the East Tennessee, Virginia, and Georgia railroad was completed, and in 1885 the East and West Alabama railway, so that transportation facilities are now exceedingly good. The slate deposits are estimated to cover an area of about 360 acres and near the junction of the two railroads above mentioned. From all that can be learned of these quarries, the investment of a larger amount of capital could be made to pay well. In 1889, a determined effort was made to secure the investment of about a quarter of a million in the slate deposits as well as marble deposits which exist in the neighborhood of Rock Mart. The methods of quarrying and manufacturing have hitherto been of the very crudest nature, and the introduction of more improved methods would doubtless result in a very decided cheapening of the cost per square of roofing slate.

Limestone.—Erom Chatoosa county was produced limestone to the value of $24,656 in 1889; lime valued at $20,000 was produced, and the remainder was used for furnace flux.

Sandstone.—A small amount of sandstone was produced in Randolph county, but the amount was almost insignificant.

IDAHO.

The stone industry in Idaho amounts to comparatively very little at present. The chief product is limestone, which in 1889 was valued at $28,545, and came from three quarries in Kootenai, Bingham, and Alturas counties. Nearly the whole amount came from the first named county and was entirely used for burning into lime. The lime is used entirely in neighboring towns.

Sandstone.—A small quantity of sandstone was produced in Ada county and was entirely used for building. The amount was insignificant.

Marble.—At Spring Basin, in Cassia county, marble was produced in sufficient quantities to supply local demands. The product is suitable for cemetery work, but it has never entered the market in competition with the well-known marbles of other regions.

ILLINOIS.

Limestone and sandstone have been produced in this state for some years. The latter, however, is of very small importance compared with the former.

Limestone.—The limestone produced in 1889 was valued at $2,190,607.

This product was obtained from 104 quarries, operated in the following counties, named in the order of the value of output: Cook, $825,800; Will, $742,177; Adams, $91,000; Jersey, $73,000; Madison, $63,000; Hardin, $58,000; Kane, $47,000; Pike, $42,000; Kankakee, $38,000; Hancock, $35,-000; Saint Claire, $32,000; Winnebago, $26,000; Rock Island, $23,000; Henderson, $25,000; Du Page, $22,000; Randolph, $16,000, and smaller amounts in Union, Whiteside, Monroe, Ogle, Stephenson, Kendall, Jo Daviess, McHenry, Green, and La Salle. It is evident that the first two named counties produce the great volume of the limestone, the amount from Cook and Will counties together being $1,567,977. Thus these two counties produce far more than the rest of the state put together. In the amount of limestone used for building purposes Illinois takes first place among the limestone-producing states. The amount devoted to building was valued at $1,084,556. In the amount of limestone devoted to street work Illinois stands second among the limestone-producing states. The amount thus used was $505,576. The value of the lime produced from limestone in this state, included in the total above given for the state, is $366,245. As flux an amount valued at $166,507 was used; for bridge work and miscellaneous purposes an amount valued at $67,723. The operations in Cook and Will counties, on account of their magnitude, the general excellence of the stone produced, and the ease of quarrying and working out deserve special mention. The region embraced by these two counties is known generally as the Joliet region. It includes territory from about 5 miles south of the city of Joliet to about 10 to 12 miles north, taking in the towns of Lockport and Lemont and running along the valley of the Illinois river. Most of the quarries are situated on the banks of either the river or the canal. The stone exists in layers at the surface, varying from 1 inch to 3 inches in thickness, and growing in thickness with the increasing depth until at about 25 feet it is found of a thickness varying from 15 to 20 inches. It is, however, rarely quarried below the 25-foot level, owing to the expense of getting it out and dressing it, since at that depth it is much harder, although the quality of the stone is superior to that in the upper levels. At the depth of 25 feet the inflow of water materially adds to the expenses of quarrying. The stone found at or near the surface is almost valueless and is almost entirely thrown away in stripping the quarry. The next two-fifths furnish stone of sufficiently good quality to be used for riprap, rubble, sidewalks, and curbing. The last two-fifths contain the best stone, namely, that used for building. It is generally of a bluish-gray color. The exposed stone is of a yellowish color from the effects of exposure to the atmosphere. It is also true that most of the Joliet stone turns more or less yellow upon exposure. The beds are divided vertically by seams occurring at somewhat iregular intervals of from 12 to 50 feet,

and continue with quite smooth faces for long distances, and also by a second set of seams running nearly at right angles with the first, but only continuous between main joints and occurring at very irregular intervals. This structure renders the rock very easily quarried and obtainable in blocks of almost any required lateral dimensions. The stone is easily worked into required shapes and takes a fine, smooth finish, and is susceptible of being readily planed. This forms a very rapid and cheap method of finishing flagging stones and preparing such as are to receive a smooth finish on the polishing bed. Enormous quantities of flagging stone are taken out, most of which goes into Chicago; but business with other cities is decidedly on the increase. The finest varieties are readily produced in forms which are capable of being turned out by lathes.

The following is an analysis of Cook county limestone:

ANALYSIS OF COOK COUNTY, ILLINOIS, LIMESTONE.

	Per Cent.
Silica	26.08
Alumina and oxide of iron	6.57
Carbonate of lime	46.90
Carbonate of magnesia	14.19
Water	6.26
	100.00

The crushing strength of this stone is 16,017 pounds to the square inch; specific gravity, 2,512. The stone obtained in the vicinity of the towns of Sterling, Morrison, Fulton, Cordova, and Port Huron is largely burned into lime. This is true of much of the stone all along the Mississippi river. The best grades of Alton stone become whiter upon exposure to the air, and some of it that has stood in buildings for twenty to twenty-five years has become almost perfectly white. The quarry at the Chester, Ills., state prison is an immense bluff about 200 feet in height. It has been worked for only the past two or three years and is now turning out fine stone. All work is done by the convicts.

Sandstone.—The sandstone of Illinois comes from counties in the northwestern and western parts of the state. The total value of the product in 1889 was $17,896. It came from the following counties, named in order of output: Henry, Fulton, Whiteside, Union, Knox, Lee, and Clay. By far the most, however, came from Henry county. It was nearly all used for building purposes.

(TO BE CONTINUED.)

William C. Day.

THE MICA MINES OF NELLORE.

TR. WARTH, officiating superintendent of the Central Museum, London has written a most interesting report upon Mr. E. H. Sargent's mica mine near Inikurti, a place 19 miles from Nellore. Mica is the talc of commerce, although scientifically speaking the latter is quite a distinct mineral. Some idea of its value may be gathered from the following approximate rule for calculating the price of ready-cut selected rectangular pieces in London. One pound weight costs as many times twopence as each single piece has square inches surface. This equation holds good between 10 and 100 square inches. Below these limits the prices are smaller and become finally nil; above these limits they are higher and would end in fancy prices. Although Mr. Sargent's mine has only reached a depth of 60 feet, no less than 20 tons of pure ready cut mica have been extracted during the past two years. It appears that the first indication for this deposit was a ridge of quartz which stood eight feet above the surface of the plain. Then Mr. Sargent found old excavations on the west side of the ridge, which he followed up. At a distance of about 10 miles to the south Dr. Warth found quite a group of more or less successful mica mines in similar rocks near the village of Utkur. The mica was associated with the same white quartz and whitish feldspar. There were also the same accessory minerals, garnet and tourmaline. One mine, called Sukhagini (black stained mine), produces mica which is stained black and brown through the spread of mang anese ore and iron between the planes of cleavage. Some slabs of very clean surface without any cracks whatever, 27 inches by 32 inches, were in store. The price of these would have been fabulous if they had not been black. We further learn from Dr. Warth's report that the sorting of the mica is very important for the trade. A large quantity of the mica is thrown in the sun. Of the mica brought to Mr. Sargent's stores at Inikurti only about 23 per cent. is finally selected for the trade. Everything else is thrown away, being either cracked, not sufficiently transparent, ripple-marked, or too small. The smallest limit of rectangular size is two inches by two inches, but such small sizes are at present very cheap, as Bengal exports too much of it. The pieces are all cut according to rectangular patterns. Pieces of the same pattern are then tied in bundles and so sent to London.

SURPRISED AT ITS ELEGANCE.

"WE are surprised at the form and elegance of the magazine. We had expected to see something of the folio character, and are pleased to see a magazine devoted to an industrial art presenting as fine an appearance as the more literary periodicals."—*J. R. Scuphans, Secretary Academy of Sciences, San Francisco.*

DURABILITY OF NEW YORK BUILDING STONES.*

ALL the stones used in building, under whatever name they may be known, are composed of a few elementary minerals; these are:

1. Silica or quartz;
2. Alumina-clay or argillaceous matter;
3. Carbonate of lime;
4. Carbonate of magnesia.

Beyond these, except in crystalline rocks, the presence of other material is almost non-essential to the composition of stone, often accidental or adventitious, and usually injurious to the integrity of the mass. The ultimate chemical composition of a stone has little to do, as a general rule, with its character for durability; nor will a chemical analysis determine the value of a stone for building purposes.

Physical Conditions of the Aggregates of the Several Named Substances.

1. The silica or quartz may occur as a mechanical aggregation of particles of sand simply cohering among themselves, or by the intervention of some argillaceous, ferruginous, or calcareous matter acting as a cement; or lastly through a partial solution and cementation of the siliceous particles themselves. In the latter case, and where the mass is pretty purely siliceous, the process may have gone so far as to give a vitreous rock known as quartzite. In many cases, however, the siliceous or arenaceous deposits present great inequalities of texture, from the aggregation of coarse particles or small pebbles among the finer materials, always to the injury of the strength and durability of the mass. Under certain conditions, these mixtures become crystalline rocks of various character.

2. The clay, or argillaceous matter by itself or with a small admixture of silica, and often more or less of carbonate of lime, becomes a slate or shale rock in which argillaceous matter predominates is unfit for a durable building stone.

3. Carbonate of lime and magnesia, or the former alone, constitutes extensive beds of solid and durable stone, but which is often deteriorated by the presence of argillaceous matter. In many limestones, the mass consists of an aggregation of fine particles which have been deposited in the form of a fine calcareous mud. Other and often very extensive beds are

*Report New York State Museum.

visibly composed of the debris of shells and other organic bodies, cemented together by the finer particles of calcareous mud, or often by the partial solution of calcareous matter. Uuder the influence of subsequent conditions, these simple mechanical aggregations of calcareous matter, or the calcareous magnesian deposits, become crystalline marbles of various colors.

In the purely siliceous stones or quartzites, the mass is too hard and brittle for easy working or comely shaping of the pieces; an admixture of clay or argillaceous matter being essential to the possibility of working stone whose basis is silica. When, however, 'his argillaceous material becomes excessive, the stone is liable to rapid disintegration from the action of the weather. While the silica absorbs but an extremely small quantity of water, the clay will absorb largely; and this, on freezing, will destroy the stone more or less rapidly. Some of the argillaceous sandstones, on drying in a hot sun and then being suddenly wetted, will crack and crumble into pieces. The same effect is often produced by the sudden freezing of large blocks which have been freshly quarried, and which still contain their water of absorption.

When the argillaceous matter is evenly and intimately mingled with particles of silica or quartz, and not in too large proportions, the stone will las a long time, and will disintegrate but slowly; but when the argillaceous material is in *seams* or *laminæ* of deposit, it is far more injurious, and every such seam in a block must sooner or later lead to its destruction. The manner of this is very simple. The clay seam absorbs water, and, holding it while freezing, the seam expands; if disintegration does not immediately follow, the seam is widened so that it admits more water on the next occasion; and so on successively with alternate freezing and thawing until an unsightly crevice is produced, which constantly widens and encroaches more or less on the adjacent parts till the stone is destroyed.

This condition occurs in the gray or light-colored freestone, as well as in the brown ones; but in the brown freestone or sandstone, there is a further cause of destruction. The coloring matter, which is also in part the cementing matter of the grains of sand, is ferruginous, the siliceous grains are covered with peroxide of iron, and this substance is intimately combined with the argillaceous matter of the mass which cements the particles. Experience has everywhere proved that the brown sandstones or freestones are not durable stones; their destructibility is not only due to the presence of argillaceous matter, but to the oxide of iron; for the gray or neutral-tinted stones, of the same composition otherwise, are much more durable.

As an evidence of the rapid decomposition of the red or brown sandstone when the siliceous element is deficient, we may sometimes find a large area, which, when broken up, decomposes so rapidly that it becomes in a few years an arable soil. The same is essentially true in some parts of the

Medina sandstone. In order to demonstrate this fact, it is only necessary to examine any building of brown-stone which has been erected for a period of twenty-five years. The New York State Library building is an example in point. The Capitol and Albany Academy have been longer erected, and were originally of better material than the Library building. The basement of the old City Hall in New York is an example of the same kind, where the brown-stone, from its inherent destructibility and from the presence of clay seams, presents a dilapidated appearance; and other examples might be mentioned. In Europe the same condition exists, and many old buildings of the red or brown sandstone are falling in ruin.

In the lighter-colored sandstones, we have mainly to guard against clay seams and too large a proportion of argillaceous mixture in the mass. Beyond this, the presence of iron pyrites is to be looked for. This mineral is present in so many rocks of this character, especially those with a bluish or greenish olive tint, that it is to be suspected in all such stones. It should be remarked, moreover, that iron pyrites (sulphuret of iron), when in visible grains, nodules or crystals, is not so dangerous or destructive to the rock as when disseminated in fine or imperceptible grains through the entire mass. This mineral, however, may be so disseminated and not prove entirely destructive, since in some stones it decomposes from the first exposure to the weather, staining the exterior of a rusty hue, and thus continuing to exude as an oxide of iron so long as any of it is reached by the moisture of the atmosphere; at the same time the free sulphuric acid unites with the lime or magnesia, if either be present, or to some extent with the alumina in the absence of the other substances; and this chemical change may sometimes go on for a long time, without seriously affecting the texture of the stone, producing no important result beyond the unsightly appearance. Generally, however, the decomposition of the pyrites produces the gradual destruction of the stone.

We have in the state of New York a class of argillaceous sandstones largely in use as building stones, and which are less known in any other state. They are of the character of rocks formerly known as "*Graywacke*," and the name might usefully be retained to designate the argillaceous sandstones of the Hudson river group, the Hamilton, Portage and Chemung groups. These beds of the Hudson river group are well known as *bluestone*, which is a compact argillaceous sandstone consisting of variable proportions of these materials.

The name *bluestone* is equally applicable to the heavy-bedded compact arenaceous layers, and the thin-bedded slaty layers, which are largely used in the foundations of ordinary buildings. Much of the heavy-bedded slaty rock of this character, which is quarried along the Hudson river valley, belongs to the Quebec group; but I am not at this time aware of

any quarries in the same formation, which furnished dressed building stone.

In the Hudson river group, this rock occurs in many localities, in very regular beds which are cut by vertical joints presenting clean, straight faces, and are thus laid in the building. The composition of these stones (that is, in the proportions of silica and alumina) often varies in the distance of a few rods; but, if well selected and laid on its natural bedding, it makes a durable building material. Much of it, however, becomes stained from the decomposition of iron pyrites, which after a length of time, either leaves the surface of a permanently rusty brown color, or the decomposition goes on till the rock crumbles or scales off in thin laminæ Sometimes the faces of the joints are coated by thin laminæ of carbonate of lime, arising from the solution and infiltration of calcareous matter; and this forms a permanent coating, which resists all further change from atmospheric influences. It is of the greatest importance that these stones be carefully selected, or otherwise they soon become disintegrated.

The flagstones, so abundantly supplied from the upper part of the Hamilton group and lower part of the Portage group, are among the most enduring of the compounds of silica and alumina. The material is a fine-grained compact argillaceous sandstone of a blue or grayish-blue color, which, when free from seams, is scarcely influenced by the action of the weather. These beds are not only used for flagstones in most of the Atlantic cities, but in Albany, Troy, and other towns along the river and elsewhere, this stone is used for door-steps and caps, window-sills and caps, water tables, etc. The stone is very strong and durable, sometimes slightly staining from the decomposition of iron pyrites, but rarely or never undergoing disintegration from that cause.

The bluestone of Malden on the Hudson river, which has of late come into use for ashlar, door-steps and sills, pillars or pilasters, window-sills and caps, water tables, etc., is obtained from some heavier beds in the Portage group along the base of the Catskill mountains. The stone has great strength and durability, wearing very slowly when used for steps, and possessing the great merit of retaining a certain degree of roughness of surface. The dark color may be regarded as the only objectionable feature.

In the central and western part of the state, the Portage sandstones are of a lighter color, usually more friable than those of the eastern outcrops. Many of the beds are of a greenish or olive-gray color, occurring both in flaggy and heavier courses, which are easily dressed and present a very good appearance. The frequent presence of iron pyrites, causing both staining and disintegration, offers an objection to their extensive use. In the western counties, however, some of the beds are nearly gray, having lost the greenish or olive color almost entirely, and at the same time have

less argillaceous matter in their composition, with scarcely a trace of iron pyrites. The stone from these beds has a very uniform gray color, a fine texture, and if quarried and dried before exposure to the frost, is a very durable stone.

In Ohio, the arenaceous beds of the Portage group furnish the friable gray sandstone from which grindstones are largely manufactured, and from which more recently large quantities of building stone have been furnished. The cohesion of the particles is slight, and the stone is very brittle on first quarrying, but becomes stronger and harder on exposure, and, if properly selected, resists the effects of the atmosphere in a remarkable degree. The strong cohesion of the particles, therefore, is not always a requirement for durability, though it is for strength, either as resisting direct pressure or the effect of tensile force.

It should not be forgotten, however, that neither all the beds of this stone, nor all parts of the same bed, are uniform in texture, composition or durability, and it will not be surprising, if in its indiscriminate use it may sometimes prove unsatisfactory as a buiiding stone.

The argillaceous sandstones of the Chemung group are generally or comparatively free from iron pyrites, and range in color from gray to olive or dark olive-brown. When quarried and exposed to drying before freezing, they are comparatively durable stone; but they cannot be safely quarried during winter, or exposed to freezing soon after quarrying. Building stones from this group, within the state of New York, have long been used, and new quarries have been opened at many points, though the stone has usually but a local importance. The more important structures erected from this stone are the buildings of the Cornell University at Ithaca.

NEW ENGLAND NEWS AND NOTES.

THE Maine world's fair commissioners report everything connected with the raising of funds for the Maine building as looking very favorable. The granite companies are responding well and although the strikes have delayed them somewhat, they will fulfill their promises for donations of granite. Several carloads have already been shipped to Chicago and several more furnished by the Red Beach and Addison companies are now ready for shipment and will be sent forward immediately. Other companies are pushing the work forward with all possible dispatch.

The Mount Waldo Granite company, at Frankfort, Me., has been repairing its wharf which has certainly made a record for substantial service, for it has been 57 years since it was built and previous to this time it had received only slight repairs. It is an example of thorough work worthy of attention.

Now that the granite strike is over, Biddeford, Me., quarrymen expect to be rushed as long as the weather will permit them to work. The big contractors got behind in the strike, and there will be plenty of work for the Biddeford stone men in helping keep up with contracts.

The slate trade is booming at East Bangor, Penn. Never in its history has there been such a demand for slate of all kinds. The orders come in faster than they can be filled. The workingmen are so busy that it is difficult to hire one just for a single day. A majority of our people own their own homes as the result of the prosperons condition of the slate industry.

The Jonesport, Me., Granite company shows some finely polished specimens of granite taken from its quarry. Some of the pieces are rich looking and greatly admired. The company will have its quarry well exhibited at Chicago.

The Monson, Mass., Granite company is increasing the force of workmen at the quarry, at present employing twenty-six men, thirteen cutters and thirteen quarrymen. They are now at work on the contract to furnish 216 feet of coping for the King fountain to be placed in Washington park at Albany.

At the Rhode Island Granite Works, Westerly, men are working nights

in order to complete government contracts. The various manufacturers do not desire any one to have a vacation at present.

The Blue Hill Granite company, of Maine, has been organized at Blue Hill, with $100,000 capital stock. The officers are: President, L. D. Willcutt,of Cohassett, Mass.; treasurer, Edmund Davis, of Hyde Park, Mass.

Norcross Brothers, of Milford, Mass., have a big government contract which m ıst be filled at once and their stone cutters struck, ninety of them quitting work at once. The firm wishes to open a non-union yard somewhere and employ non-union help, to which, it is said, they are willing to pay as good wages as are paid in the union. The superintendent visited Biddeford, Me., to see what advantages that city could offer them, and consulted a number of local stone men to see what the prospect would be for running a stone yard without interference from the union. Nothing definite was decided upon and it is uncertain what will be done.

Much interest has been manifested in the Christian Hill granite quarries at Bethel, Vt., lately, as capitalists have become interested in them, and there is prospect that they will be worked again. About $30,000 worth of the top layers from these quarries has been taken out in the past, and the under granite shows up much better than the top, which has been slightly discolored by the water oozing down. Specimens from the ledge have been tested by experts and pronounced free from iron or other impurities and of excellent quality, much resembling the products of the Westerly, R. I., quarries. The Christian Hill quarries produce three kinds of granite, light, dark and medium. There are seventy-five acres in the ledge. In the past stones have been quarried fifty feet long, and there can be taken out pieces over 100 feet long, the quarry being situated especially favorable for this as it has a dip of only two feet in fifteen. A stock company is being organized with a capital of $200,000 for the purpose of quarrying, cutting and polishing this stone in Bethel.

George Green, superintendent of the New England Granite Work at Concord, has resigned, to accept the position of manager of the Maine and New Brunswick Granite company, of Calais, Me.

The Prospect quarry on Hegan mountain, Waldo, Me., is now doing a large amount of work. Nearly $100,000 has been expended on the plant and sixteen cargoes have been shipped this summer. A sixty-horse power engine has just been set up to load the cars with and do other work as required; seventeen horses and eighteen oxen are employed in the quarry and a thirty-two horse power engine is on the wharf to load vessels. Three hundred thousand paving stones are ready in the quarry. Twenty-five new buildings, great and small, have been built along the line of the mile

track from the quarry to the wharf. Eleven new dwelling houses with cellars are owned by the company. The pay roll last month was $11,000. This month there will be about 250 men. About all are residents of Waldo county. A small number are from Bluehill and four are Italians.

W. R. Close, of Bangor, Me., is trying to make some arrangement to build one of his new patent lime kilns in Rockport, taking advantage of the renewed interest and quickening of the business there. Mr. Close claims that he will build a kiln which will not only burn lime more cheaply than at present but will also furnish steam power to the amount of 200 horse-power for other enterprises at no extra cost. The scheme in theory is far in advance of our modern times and Mr. Close will accomplish a great triumph if he makes it go. He will probably build a kiln in Rockport very soon if he finds a site and proper encouragement.

The Union Granite company, which has extensive works at Long Island, Friendship, is negotiating for a lease of the East Boston quarry at Vinalhaven. The quarry is now leased to the Bodwell Granite company. The lease will soon expire, and the owners are not disposed to renew it under certain conditions.

In September 924 tons of cut granite were shipped from Milford, Mass., against 1,796 in the corresponding month last year. The trouble in that industry has been responsible for the decline.

James and Thomas Bissett have joined the manufacturing firm of Edwards Brothers and Jackman, Williamstown, Vt. A side tack has just been built to their new shops, and work is getting well under way. The company has two polishing machines in use.

A good quality of boulder granite is being quarried in Williamstown, Vt.

The Grearson, Moore & Company granite sheds at Williamstown, Vt., are taking on their accustomed lively appearance again. They have seven apprentices and a number of their old employes, and will occupy an addition to their present quarters. More good granite cutters could find work there.

H. C. Nye, of Barre, Vt., is completing a pretty cottage granite monument for parties in Indiana. Mr. Nye has an enviable reputation as a maker of monuments and his work will not injure the good opinion of his customers.

In a note from Barre, Vt., occur the following paragraphs:

It is said that about 200 Scotch granite cutters are on their way from Scotland to this town.

James Gazely has bought the Worthen & Trow quarry.

C. H. Hunton & Company are erecting a shed for statuary and carving work.

The Steam Stone Cutter company of Rutland, Vt., has secured space in the world's fair building at Chicago for the exhibition of three of their channeling machines during the great fair. The company will construct three machines of different sizes for the exhibition.

Somebody went into the stone sheds of Littlejoin & Milnre at Barre, October 13, and knocked the corners off three stones, worth $3,000, which were nearly finished. They were of course ruined. The work on the pieces had all been done by non-union men, and the shed being a large one, it must have been some one familiar with the location of the different men.

In reply to a question as to the truth of the statement made some time ago respecting the unreliable character of some new firms in Barre, a gentleman well qualified to know, writes as follows:

If it was published when the strike was in progress it tells the truth. Now the quarries are all open and no discrimination is used, so any dealer who claims he can't get the best of stock is a liar and ought to be exposed. There are dealers who hurt the business and they ought to be compelled to quit business. We have some of the best granite quarries on earth and an inexhaustible supply, and a dealer who will send out of town anything but the best is a pest and a villain.

The granite troubles at Concord, N. H. and Milford, Mass., are still unsettled. Precisely similar propositions have been submitted in all centers of the granite industry. The hundreds of cutters in Quincy and Barre accepted and went to work. The mere hand-full in Concord, less than 100 now, continues to hold out, and the 300 at Milford seem determined to prolong difficulties as long as possible. No fair-minded man but wants that all laboring men should have their rights, but some are beginning to doubt the justice of a labor union branch being supported in idleness by other branches, the idleness being the result of non-acceptance of exactly the same terms which the men at work thought fair. At Concord every offer of the business men of the city to act as arbitrators has been curtly rejected, and the union still awaits the discharge of two men who left it and went to work. The fight will probably end by the removal of the New England Granite Works from the city and the closing of the quarries operated by that company. That means a big loss to the city, but it will probably stand the loss and in the end fully recover from the deadening effects of the strike. It looks as though the Concord branch didn't want to settle on any fair basis and will want to take charge of the entire business of the manufacturers next.

Mr. John Patch, superintendent of the old Sutherland Falls, Vt., marble quarry, says they have raised thus far this season 2,002 blocks, ranging from 75 to 100 cubic feet, worth from $1.00 to $1.25 per foot. This quarry is only

one of the large number of different quarries owned by this company.

The annual meeting of the Monson, Me., Lakeside Slate company shows its affairs to be in excellent condition. The quarry at Monson has been well opened and is producing slate of the finest qnality. From all indications the company has a valuable property, and its success is already assured.

The W. N. Flynt Granite company, at Monson, Mass., has taken a contract to furnish the stone for a new depot on the New York, New Haven and Hartford Railroad at Berlin, Conn. It has also contracted to furnish the stone for the New Britain water works. The stone will be especially fine.

The Tunbridge, Vt., Granite company has commenced operations. A new stone shed has been erected in the village near the blacksmith shop where has been arranged a water power polishing machine. Several experienced hands have commenced quarrying monumental stock on the town ledge known as Brocklebank Hill. It will be remembered by those who attended the world's fair this fall that a very handsome monument made by Messrs. Bement, Farrar & Company, from the Tunbridge granite stock stood at the entrance of floral hall. Your correspondent was informed by the well known proprietors of the firm, B. R. Bement and E. E. Farrar that they have lately received several orders for monuments and they feel quite sure of a successful and prosperous business.

George D. Perry, of Machias, has bought a granite privilege at Rocky Hill, Jonesboro, Me., and will open a quarry there. This is the seventh quarry in the town, and there are more in prospect.

BEST OF ITS KIND.

"THE September number of STONE was duly received and it is certainly a work of more decided merit for marble, granite and stone workers than any journal published in the United States."—*John G. Blampied, Contracting Agent for McDonnell & Sons of Buffalo, N. Y., and Quincy, Mass.*

CONSIDER IT A GOOD THING.

"Please enter our name on your subscription list and draw on us at sight for the amount. From sample copy sent us we consider it a good thing and we want it."—*Fish & Crist, Springfield, O.*

DRAWING FOR WORKMEN.—IV*

IN the last paper it was promised that in this the "line of chords" would be described in connection with the sector, but previous to doing so it will be well to prepare the student first with a further knowledge of some of the instruments necessary for a better understanding of the sector's capabilities.

All the divided lines on common rules are necessarily unalterable, and can therefore, only be made use of when they happen to be adapted to the degree of magnitude, or scale on which the drawing or construction is to be made. Theinstrument called a *sector* and which is sometimes included in a box of instruments, is intended to obviate this deficiency of common scales: it consists of a jointed rule, like a carpenter's common two-foot, single-jointed rule, but is generally made of ivory and is of superior workmanship. The instrument consists of two flat rulers, united by a central joint, and opening like a pair of compasses. It carries several plain scales on its faces, but its most important lines are in pairs, running accurately to the central joint, and making various angles according to the opening of the sector. The principle on which the double scales are constructed is contained in the 4th Prop. of the 6th Book of Euclid, which demonstrates that "the sides about the equal angles of equiangular triangles are proportionals," etc.

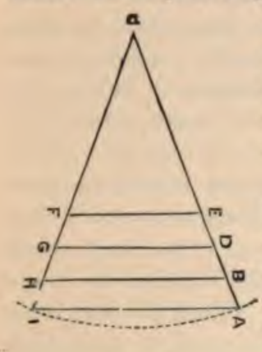


FIG. 20.

Now let A C I (Fig. 20) be a sector, or, in other words an arc of a circle contained between two radii; and let C A, C I, be a pair of sectoral lines, or a double scale. Draw the chord, A I, and also the lines, B H, D G, E F, parallel to A I.

Then shall C E, C D, C B, C A, be proportional to E F, D G, B H, and A I respectively. That is, as C A : A I :: C B, : B H, etc. Hence, at every opening of the sector, the transverse distances from one ruler to another are proportioned to the lateral distances measured on the lines C A, C I; and thus we may apply any radius transversely to the line of chords to measure or lay down any given or required angle; and apply any line transversely to the line of lines, to divide it in any required proportions. The sector is therefore seen to be of universal application, whilst the use of plain scales is limited and special.

There is also usually found on the *sector* near the center edge, a decimal

*By Fred T. Hodgson, author of "The Steel Square and Its Uses," through the courtesy of *The Operative Builder* of New York.

scale from 1 to 100; and in connection with it, on one of the sides, a scale of inches and tenths. These are identical with the lines on the plain scale, previously mentioned, but the latter are more commodiously placed for use. On the other side is found logarithmic lines of numbers, sines, and tangents, but as these are more complicated than the ordinary plain scales, we defer the consideration of them until we have discussed the double scales.

The sectoral double scales are respectively named the line of lines, chords, secants, sines, and tangents. These scales have one line on each ruler, and the two lines converge accurately in the central joint of the sector. Several of these lines are marked so that the student will have no difficulty in finding them on the rule.

The "line of lines" consists of 10 primaries, each subdivided into tenths, thus making 100 divisions. Its use is to divide a given line into any number of equal parts; to give accurate scale measures for the construction of a drawing; to form any required scale; to divide a given line in any assigned proportion; and to find third, fourth and middle proportions to given right lines. The scales can be applied to other purposes; but, if we take up those mentioned, they will be sufficient for our purposes. Before entering upon these propositions we would remark that a *lateral* distance is one taken from the center down either half of the scale; and a *transverse* distance is one measured across from scale to scale. Thus, in Fig. 21, 51, 52, 53, etc., are lateral distances; and 1 to 1, 2 to 2, 3 to 3, etc., transverse distances.

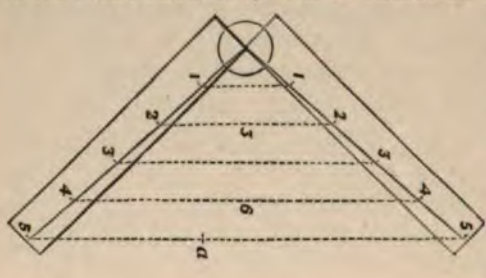


FIG. 21.

1. To divide a given line into 8 equal parts: Take the line in the compasses, and open the sector so as to apply it transversely to 8 and 8, then the transverse 1 to 1 will be the eighth part of the line. If the line is to be divided into 5 equal parts, apply it transversely by the compasses to 10 and 10, and the transverse from 2 to 2 in the fifth part. When the line is too long to fall within the opening of the sector, take the half or third of it. Thus, if a line of too great length is to be divided into 10 parts, take the half and divide into five parts; or if into 9 parts, take the third and divide into 3 parts. And in other cases it may be necessary to divide the portion of the line into the original number of parts, and set off twice or thrice to obtain the required division of the whole.

2. To use the line of lines as a scale of equal measures: Open the sector to a right angle, or nearly so, and obtain dimensions by transverse measures from scale to scale, taking care that the points of the compasses are directed

to the same division on both rulers. Thus the transverse measures to the primaries 1 to 1, 2 to 2, etc., will give any denomination, as feet or inches, and similar measures to the same subdivisions on both sides will give tenths.

3. To form any required scale, say one in which 285 yards shall be expressed by 18 inches. Now, as 18 inches cannot be made a transverse, take in the compasses 6 inches, the third part, and make it a transverse to the lateral distance, 95, which is a third of 285. The required scale is then made; the transverse measures to the primaries being 10 yards, and to the subdivisions so many additional yards.

4. To divide a given line in any assigned proportion—say a line of 5 inches in the proportion of 2 to 6: Take 5 inches on the compasses and apply it to the transverse of 8 8, the sum of the proportions; then will the transverse distances, 2 2, 6 6, divide the given line as required.

5. To find a third proportional to the numbers 9 and 3, to lines 9 inches and 3 inches in length: Make 3 inches a transverse distance to 9 9; then take the transverse of 3 3, and this measured laterally on the scale of inches will give one inch. For 9 : 3 :: 3 : 1.

6. To find a fourth proportional to the numbers 10, 7, 3, or to lines measuring respectively 10, 7, and 3 inches: Make 7 inches a transverse, 3 3, will measure on the scale of inches 2 1-10. For 10 : 7 :: 3 : 2 1-10.

The line of lines is marked L on each leg of the sector; and it is to be observed that all measures are to be taken from the inner lines, since these only run accurately to the center. This remark will apply to all the double sectoral lines. With regard to some of the preceding operations by the line of lines, we may admit that they are suggestive rather than practically useful. They familiarize the young draughtsman with the capabilities of scales, and offer him useful hints for the general construction and management of lineal measures.

"The line of chords," to which we have previously referred, possesses the same advantage over that on the plain scale that the line of lines has over the single scales. With the line of lines we operate on any given line that will come within the opening of the sector, and with the line of chords we can work with any radius of similar extent. This last is constructed by making the lateral distance of the chord of 60°, which is radius, equal in length to the line of lines. All the intermediate degrees between 1 and 60 are then set off laterally from the center, on both rulers, by taking on the line of lines a measure equal to twice the natural sine of half the angle. Thus, for the chord of 30°, refer to Sherwin's tables, or to some other authority, and find the natural sine of 15°, which is 2,588,190, when radius is 10,000,000, and the double of this sine is 5,176,380. Now the line of lines as radius is equal to 100, in place of 10,000,000, and the measure of

the double sine must therefore be taken from it in two places of figures, instead of seven. We see at once that the length of the chord is between 51 and 52 on the line of lines. Take in the compasses, as nearly as possible, 51 and three-fourths, and this measured from the center on the line of chords, will give the chord of 30°. The young draughtsman ought to exercise himself and *test his sector* by this and similar operations; for it is equally important that he understand the structure of his scale, and be able to ascertain that the various lines of his sector have a due relation to each other.

The line of chords is also used to protract and measure angles; it is distinguished by the letter C on each leg of the sector.

There are other lines on the sector besides those mentioned—namely, the line of polygons, the line of secants, the line of tangents, the line of numbers, and the line of sines; but as these are chiefly used in the solution of questions in trigonometry, and by navigators and surveyors, it would be out of place in these papers to describe their applications at length, especially when the artisan draugthsman can procure pocket-books containing all the necessary tables for a very small amount. There are many other scales besides the ones named but I think I have presented all the ordinary draughtsman will in all probability ever require.

[TO BE CONTINUED.]

A COMPLETE COMPENDIUM.

ONE is inclined to smile when he picks up a magazine entitled STONE. But the magazine which carries this peculiar title is so well named that one has simply to glance at its contents to be convinced that no other name would be appropriate. It is a complete compendium of the history, doings, actions and uses of stone, a history which when properly studied is so interesting and instructive that one is astonished at the amount of information it contains. "The Road Problem," "Notes on Quarrying," Decorative Stone Cutting, "Modern Power Plants," and the "Building Stone Industry of the United States" are all very able articles and full of valuable instruction.—*The Inventive Age.*

READ WITH INTEREST.

"WE inclose check to renew subscription to STONE, which we read with interest and consider of value to all whose interests it covers, as well as to the general reader whose tastes lie in the direction of its field.—*C. W. Canfield, for New England Monument Co.*

NATIONAL ASSOCIATION OF QUARRY-OWNERS

FROM Sylvester Marshall, president, comes the following call for the second annual meeting of the National Association of Quarry Owners of the United States. Organization being the watchword of the time, it is needless to here enlarge upon its benefits to quarrymen as well as others in different lines of business. Special attention, is, therefore, called to Mr. Marshall's call.

To Quarry Owners:—

The second annual convention of the National Association of Quarry Owners, will be held at the Grand Pacific Hotel, Chicago, February 21, 1893, at 11 o'clock a. m. A full attendance of all members is earnestly desired as business of special importance will come before the meeting.

A cordial invitation to attend this meeting is extended to every quarryman in the United States. If local associations in the more remote stone districts, will send delegates, they will be gladly welcomed.

There are to-day in the United States 4,000 quarries. These quarries represent an invested capital of nearly or quite one hundred million dollars. As in all other great lines of business, conditions arise from time to time and evils creep in which are entirely beyond the control of individuals. We quarrymen have arrived at that point where organization is an *imperative necessity*. Through lack of organization conditions have arisen in the stone trade requiring intelligent adjustment. I will mention one of many. Prices on all kinds of building material, excepting building stones, have advanced during the past year from 10 to 80 per cent. Why are the quarrymen not sharing in the general prosperity? There is a cause, likewise a remedy. Let us come together to seek the one and apply the other.

The National Association of Quarry Owners completed its organization last February. It is, therefore, just starting on a career of usefulness. It needs, and should have, the earnest support of every stone producer in the country.

All quarrymen expecting to attend the meeting on February 21, 1893, are requested to notify the undersigned of such intention not later than February 1, 1893.

SYLVESTER MARSHALL, Pres.

EDITORIAL COMMENT.

THE result of the presidential campaign which closed November 8 with such a sweeping victory for the Democratic party is probably a genuine surprise to everyone who has followed the progress of the campaign, and to no one in greater degree than the winners themselves. The causes which led to the defeat of the Republican party need not be discussed here. The party is utterly overwhelmed and the first time for a quarter of a century will have no voice in the administration of governmental affairs at Washington. However, this is a good thing. It enables the Democratic party to promulgate its policy without opposition. Eight years ago when Mr. Cleveland was elected president, the senate was Republican so that legislative measures originating in the popular branch of the government were subjected to revision in the senate and practically became Republican measures when passed. That is done away with in this case and the party which the people have suddenly raised to supreme power must stand or fall by its own acts. The verdict of the people is just. A political party should be permitted to carry out its avowed policy without opposition from its rival. It remains to be seen what effect the policy of the party soon to come into power will have upon the business interests of the country. Whatever may be the party affiliations of men they must, with one accord, bear witness to the wise, patriotic and able administration of Benjamin Harrison, and he will retire to private life with the good will of the entire country.

ALL laboring men are not unreasonable in their desires to better their condition. The bricklayers of Boston wanted an eight-hour day, but the request was not coupled with the threat to strike if it were not granted and the pay still retained at the ten-hour figure. Beginning November 1 they have worked eight hours for eight hours' pay the rate per hour being the same which has prevailed all the building year. The success of the Boston bricklayers in securing an eight-hour day proves conclusively that employers do not object to it. The opposition is all directed against the methods which have been taken to get it, and the disturbances have all been caused by the arrogant and unreasonable action often taken to enforce the demands. Eight hours' work for eight hours' pay is an ideal combination, and is a basis of labor which would greatly reduce the army of unemployed; but when they who ask for ten hours' pay are met with opposition they ought to understand that it all arises from the unreasonable nature of their demands and not from any opposition to an eight-hour day as such. The mandatory action of the United States government in enacting a law saying that all government work shall be done on the eight-hour basis is a long step toward the general adoption of the reform. Employers must suffer

to some extent, because they will either be obliged to hire two sets of hands or enlarge their plants to secure the same output from their business. But that is one of the results of all reforms, someone must suffer, and in this case it is the employers of labor. However soon the reform may come the action of the Boston bricklayers is commended to all labor reformers as a shining example of moderate but decisive action.

COL. ALBERT POPE, of Boston, is nothing if not persistent. Sometime ago he began agitating the question of better roads. Perhaps his connection with a gigantic bicycle combination may have led him to it in the beginning. The result of the bettering of the condition of the roads upon the sale of bicycles can be figured out by anyone with resort to a formula of Euclid. However, the fact remains that the proposition of Col. Pope is a worthy one, for, if the people of the United States could save the enormous waste of poor roads for one year the national debt could be wiped out of existence and a comfortable sum remain to be invested for the benefit of Uncle Sam when he gets too old to work. Col. Pope's latest action is sending out copies of a petition and circular letter requesting the signatures of as many people as possible to be attached to a monster petition to be presented to congress praying for the establishment of a permanent road exhibit in Washington. The idea is to get a petition with several miles of signatures and then literally bury congress under it. It is also proposed to establish a road department and an institute of road engineering in Washington and secure a congressional appropriation for a road exhibit at Chicago next year. STONE fully appreciates the importance of Col. Pope's endeavors, for few people are more affected by poor roads than quarrymen stone dealers, builders and others whose interests it represents, but the outlook for the successful prosecution of such an enterprise as is proposed, doesn't appear as bright as it did November 7. But be that as it may, STONE is heartily in favor of improvement in the common roads as a perusal of the articles which appear in its pages from time to time prove, and if Col. Pope has outlined the ideal plan his scheme is heartily indorsed.

THE Indiana soldiers' monument commission is in a serious complication of difficulties. The committee appointed to pass judgment upon the models for war and peace groups of statuary submitted their report last month, awarding the first prize for the peace group to one sculptor and the first prize for the war group to another, and closed by saying that the two groups should be executed by the same hand. The commission is made up of business men and not artists. They selected three of the foremost sculptors of the country, headed by St. Gaudens, as a committee of award and are now confronted with the above difficulty. The award of prizes has been made, but at this writing no further action has been taken. Another thing is making life unpleasant for the commissioners. The veterans of the Rebellion, and some who are not veterans, have united in a demand for the removal of the Mexican war dates from the monument, and are reported as indicating their intention of fighting further appropriations if the obnoxious dates are not removed. It is understood, too, that the commission is divided. Speaking impartially, it is difficult to see why, on a state monument, the soldiers of all wars in which Indiana men took part should not be commemorated. It is

customary in other sections of the country, and in those portions where soldiers enlisted in all four of the great wars in which this nation has been engaged from 1776 down, all four dates are placed on the monuments. It is certainly to be hoped that appropriations will not be fought, nor any other obstructionary measures instituted to delay the completion of the monument. The time is none too long between now and the meeting of the national encampment here next summer, and surely, Indiana, with her splendid record of achievements in all departments of human endeavor, does not want to present an unfinished monument to the old soldiers of the country as the evidence of a quarrel over so small a thing as the matter of a war date.

ARE prize sculptural or architectural design contests productive of the best work and adapted to the securing of the best results from an artistic point of view? This question has been brought forcibly before the public by the decision of the committee on the Indiana soldiers' monument prize group contest just closed. There are two ways of looking at the question. From the standpoint of the young, unknown artist, prize competitions are beneficial. Many a young artist has acquired fame and popularity by the acceptance of a prize design or sculptural model. Success in art being so much dependent upon acquaintance, a young artist can well afford to put his best work into a model for prize competition, for, whether his model is accepted or not, it will receive careful examination and its merits will be more or less thoroughly discussed. All that is beneficial to the artist. On the other hand, when building a memorial structure or erecting an impressive, enduring building *only* the best is wanted, and the idea of one artist worked out from the foundation to the final touch is, in the nature of things, more symmetrical and homogenous than the combination of designs of one man for the main structure and others for embellishments and decorations. The Lincoln monument at Springfield, Ill., is a representative of the harmonious development of t e conception of one man, Larkin G. Mead, from foundation to cap-stone. Yet monuments in which the conceptions of a number of different men are blended are numerous and may be pointed to as representatives of combined conceptions. The logical consideration is against it, however. Now the commissioners are undecided whether to let the result of the contest stand as it is and have both groups executed by the same hand, or advertise another contest. There is much to be said on both sides, but the wisdom of the commission has carried it safely through so far, and is not likely to desert it now. Whichever way the decision may be rendered, the result will be a monument of which all the people of whatever state may be proud.

THE Vermont legislature has grappled with the problem of regulating strikes and lockouts upon what seems to be a reasonable and equitable basis. After the experience of one of Vermont's most prosperous towns with the granite strikers the past summer it proves that the state is alive to the interests of its business enterprises by its prompt endeavor to pass a law to regulate such difficulties in the future. The need of such legislation is made all the more apparent by the continued refusal of New Hampshire strikers to arbitrate existing difficulties, taking the ground that there is nothing to arbitrate. If that assertion is true surely there is no reason for continuing the strike. Discussion of the

Hastings bill may reveal weaknesses, practical application of its provisions may reveal others. It would be strange if such weaknesses were not found; but in the main the provisions seem to be just, and STONE hopes to see the bill become a law and be put in operation at once. The New Hampshire and Massachusetts legislatures will do well to follow Vermont's example and enact laws which shall make submission to arbitrators compulsory. Compulsion may be a hard word but in the case of unruly children it is sometimes necessary. It may be in this case.

ON another page is printed the call for the Quarrymen's Association to be held at Chicago. It will be noted that particular stress is laid upon the fact that all building materials excepting stone have advanced in price during the past few months, and that discussion of ways and means for securing an equitable portion of this increase for quarrymen will be an important feature of the meeting. The point is well urged and if the wisdom of the association represented in the meeting can devise some way for benefiting quarrymen, all the stone producers of the land should join in a vote of thanks. STONE recommends that quarrymen leave their deposits of solidified wealth, no matter in what part of the country their homes may be, and go to Chicago for a week, not alone to attend the meeting, but to see, also, what is being done in that wonderful city, the crowning manifestation of the wonderful progress of America.

STONE is in sympathy with all reasonable attempts of workingmen to better their condition. But it does not believe that the direction of the affairs of workingmen's organizations should be intrusted to inflammatory, self-constituted leaders, out of sympathy with national institutions and utterly un-American in conduct and utterance. Such leaders do not now and never have represented the better and larger class of American workingmen, whether native born or immigrants from other lands less favored. This is brought forcibly to public attention by an article in an anarchistic sheet discussing the charge of Judge Paxon in the Homestead cases. The article is reproduced in the organ of the Knights of Labor with commendatory indorsement. The writer says: "It is hard to maintain even a remnant of respect for the judiciary," and then as if the vials of his wrath had burst with the intensity of his hatred for the law-abiding American citizens, he hurls the following invectives at them all: "Out upon these monsters from demon land and their devil law! Men of America, if that hellish profanation of God's justice and American law is allowed to work through to its satanic end, the generation of republican citizens that give it cowardly toleration will deserve to be drowned in their own blood as apostates and traitors. If this Homestead infamy stands then is the liberty of the American citizen a silly myth and we may as well move to Russia or Persia." Whatever law-abiding citizens may think of the Homestead affair, they will never indorse such inflammatory utterances as the above, and the sooner the writers of such anarchistic articles move to Russia, and thence to Siberia, the better it will be for the workingmen of America. This country should have no asylum for anarchistic or idiotic promulgators of insurrectionary measures.

PUBLISHER'S ANNOUNCEMENTS.

A SUCCESSFUL STEAM SHOVEL.

The accompaning illustration shows a "Little Giant" steam shovel at work loading broken rock and sticky blue clay in one of the largest stone quarries in the state of Pennsylvania.

This machine was desgined and placed upon the market some years ago by the Vulcan Iron Works Co., of Toledo, O., a firm which has long been identified with the manufacture of excavating machinery, and whose steam shovels and dredges are well known and may be seen in use throughout the length and breadth of the United States and Canada. This enterprising company, some years ago, recognizing the demandthere was for a steam shovel which could be easily transported without "knocking down" and used off the line of a railroad and in out of the way places, entirely inaccessible to a large and heavy track machine, designed the "Little Giant" expressly to fill this want, and the unprecidented sales of these shovels together with the very strong testimony of the many using them all goes to prove their adaptability to the uses for which they are intended. The leading features given to this, their very latest design of steam shovel are, traction wheel with steel tires 12 inches wide, in place of car wheels thus doing away with the necessity of a railroad track, a self propelling device by means of which the shovel can propel itself over ordinary country roads, up and down hill with ease and at a speed of from three to four miles an hour; an all steel car frame and house combining the greatest strength possible with the minimum weight, a steel crane of design very recently patented a steele swinging circle and independent engines for swinging the crane. The above, together with the general details and arrangements of the parts of the whole outfit makes a thoroughly complete, light, portable, durable and quick running machine with comparatively few parts to break or get out of order and a capacity of from 800 to 1,200 cubic yards per day.

The great strength of these machines enable them to handle the hardest sort of material with ease, in fact they will dig anything short of solid rock and do it day in and day out with but few breakages and only ordinary wear and tear.

The "Little Giant" steam shovel is being used extensively in brick yards, iron mines, stone quarries and gravel pits, for digging, irrigating and drainage, placer mining, grading city streets and country roads, loading broken stone, stripping coal, slate, stone and iron mines, loading stock, pile ore, etc., etc.

The reputation of The Vulcan Iron Works Company for high grade machinery is so well known throughout the land that a steam shovel with their name upon it is a guarantee in itself that only the very best materials and workmanship were used in its conetruction.

W. H. Anderson & Son, of Detroit, Mich., make an excellent quality of stone workers' tools and they tell all about them on another page of STONE. Anything you want of that kind can be furnished you by the firm, and a good article will be forthcoming when an order is given. The production of stone workers' tools having been reduced to an exact science it pays to patronize well known firms in purchasing.

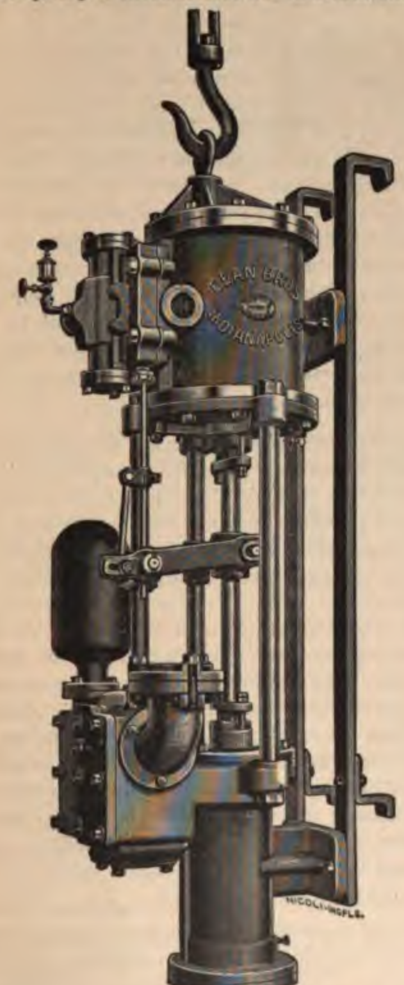
Theo. Alteneder & Sons, Philadelphia, Penn. have an announcement on another page of this magazine in which they tell who need drawing tools where to purchase to good advantage. They also mention their catalogue which it will pay any architect, stone cutter or anyone else

who has any use for such instruments to send for, just to refer to when you think of buying.

Jarvis Bros. have purchased a quarry at East Montpelier, Vt., removing to that location from Barre. New sheds have been erected and we are advised that they will now handle other granites in connection with that produced at Barre. Their polishing mill at East Montpelier is in full operation.

The accompaning illustration shows one of the pumps made by the Dean Bothers Steam Pump Works, of Indianapolis, Ind.

The pump is intended for use in mines, shafts,



wells, quarries, pits or relieving flooded mines or in any place where a portable pump is reqrired. It is a single cylinder, direct acting pump occupying but little space. Being double acting it throws a continuous stream of water and can be operated suspended by a hoist or attached to side of shaft. In either case it works equally well. It has the new noiseless valve gear with adjustable stroke which has proven to be the best device yet invented for operating the valves of steam pumps. They are made with a view to withstanding the rough usage to which they are subjected and are suitable for permanent use in mines. When required the water cylinder is made of gun metal or bronze to resist the action of bad mine water. The pumps are made in a variety of sizes and combinations. All pumps are made under consecutive numbers and all parts are made interchangeable and are thoroughly tested and inspected before leaving the shop. The pump shown in the illustration has steam cylinder 14 inches diameter, pump cylinder 8 inches diameter, stroke 12 inches, suction 6 inches, discharge 5 inches. The firm would be pleased to give any information desired in regard to these pumps.

A. J. Paden, of Portsmouth, O. will erect a $5,000 residence of Otway sandstone or freestone.

The Brandywine Granite Co., which has been using the Locke patent cableways for the last six or seven years have just added their fourth, probably the largest of its kind in this country. The engine is the largest cableway engine ever made, being 75 H. P. and it has drums 66″ in diameter. The cableway has a clear span of 1,200″. The main cable is 2½″ and the load to be carried ten tons. This is put in under the joint patents of M. W. Locke and T. S. Miller, the improvements of the latter being in the method of supporting the hoisting rope, which is very much simpler than the old style fall rope carriers as invented by Mr. Locke. An illustration will be shortly made of this cableway showing the quarries and will be given to our readers at an early date. Manufactured by the Lidgerwood Manufacturing Company of New York.

George B. Eckhardt of Toledo, O., has had a good trade this season in his Scientific Polishing Wheels, notwithstanding the stagnation in the granite business. Every one who has bought a wheel say it is the best wheel they ever saw. Mr. Eckhardt wants every man owning a polishing mill to try a wheel and says he will take back all wheels which do not prove successful. Eckhardt Brothers have the contract for ten Red Beach granite columns and curved

marble caps for St. Patrick's Church, Toledo, and have more business altogether than any former year. The consequence is they will enlarge their shop immediately.

The Lincoln Iron Works of Rutland, Vt. send out a neat folder of eight pages, with cover, giving much information respecting the stone machinery they build. They build all sorts of stone sawing machinery and furnish accessories, and planing machinery and rubbing beds are specialties. The little folder has much information inside its covers, but the large illustrated catalogue they issue contains more and is sent free The company is enjoying a good trade and it will pay you to make inquiries of them before purchasing.

The well known trading firm of Maris Machine Company of Philadelphia have sold out to, and are succeeded by the firm of Maris & Berkley. The business of making building cranes of all descriptions, overhead tramways, Teal portable hoists, trolleys, etc. in which the original firm built up an enviable reputation, will be continued at the old address, 2343-2345 Callowhill street, Philadelphia. The success of the old firm will be repeated by the new one, and the same good machinery will command attention as heretofore.

A representative of STONE dropped in on Mr. Rockwood, manager of Western department of W. H. Perry & Co., of Concord, N. H., recently and found evidences of prosperity in nicely fitted offices and a busy force of workers on designs for rock faced monumental work in which the firm practically enjoys a monopoly.

If you are interested in political matters and at the same time, willing to learn something about the "best barrow on earth" we would advise not to let a day pass before writing for the "Presidential Hand Book" which is a veritable encyclopedia of matters political, containing histories, principles and statistics of all parties, enabling you to "floor" your opponent irrespective of what his party predjudices may be. It retails for ten cents, but one of our most interesting advertisers, The Kilbourne & Jacobs Mfg. Co., of Columbus, O., are sending them free, interleaving them with their advertising, which will prove as beneficial to you as the other information if you but give heed to it when in need of something in their line.

Considerable discussion has been going on among railroad men concerning the largest single shipment of freight ever made. It is proved beyond possibility of successful contradiction that the honor of making such shipment belongs to the Broderick & Bascom Rope Co. of St. Louis. A short time ago one of the above firm called upon a prominent official connected with the Wabash road and was informed that the famous Jumbo shipment of the firm was about to be eclipsed by the shipment of a locomotive, bound for Mexico, over the Wabash lines, the engine being from 70 to 80 feet long. But that shipment doesn't controvert the claims of the company. Their claim is that they have made the largest single shipment on one car ever made, and they stand by that statement today. The cables and reels weighed 140,000 pounds and the weight of the car was 52,000 pounds, a total of 192,000 pounds. The car had four sets of trucks under it and the wire cable was wound on two reels. After examining all the statements of the railroad officials and comparing them with the claims made by the Broderick & Bascom Rope Co. it is clear that the latter company still leads as the shipper of the largest single load of freight in this or any other country. It is well to say, too, that the company is issuing a fine 100-page catalogue which is being sent to any one upon application.

American Hoist & Derrick Company of St. Louis, Minn., and 48 South Canal St., Chicago, report that they are having a very busy year and a growing demand for their contractors' and quarrymen's machinery in the South and East, having recently shipped machinery to Charleston, S. C., Mt. Airy, N. C., Hagerstown, Md., Baltimore, Md., Brooklyn, N. Y., New York City, Hartford, Conn., North Adams, Mass., New Bedford, Mass. and many other points in these sections. They are at present adding many machines and two buildings to their already large plant and are at work on their catalogue for 1893, which will contain new machinery and will be better than any previous issue. Any one interested in handling stone cheap will do well to ask for a copy of their catalogue; it's a good thing.

From the Concord Axle Company, Penacook, N. H., comes the pleasing intelligence that "Customers are calling for goods faster than we can manufacture them." This company says that there is an ever-growing demand for the "genuine Concord axle" their principal artical

But they also say that their stone polishing machine is selling well to everybody's satisfaction, and, as it has interchangeable parts it takes well with users, as any part may be ordered by number. They keep a number of machines always on hand for prompt shipment.

A note from John W. Philpott, sales agent of the New Jersey Car Spring and Rubber Company of Cleveland, O., says that their trade is good and enjoying a steady, healthy growth. The company has recently moved to larger quarters and is now located at 15 Michigan street. The company manufactures channeling machine springs which are well liked by users and one firm in Indiana ordered four sets as soon as the first set was tried. The firm has had good results from an announcement in the weekly auxiliary of STONE. One of their articles deserving special attention is a special steam hose, branded Extra Para, made either plain or wrapped with marline or galvanized wire.

On a recent visit to the sandstone quarries of northern Ohio, a representative of STONE made inquiry as to where most of the iron saw blades came from. The answer was invariably the same: "From Reeves Iron Company, Canal Dover, Ohio. Their blades are all of the proper length and straightened by machinery." The company referred to makes an announcement to readers of STONE in the advertising pages of this issue. In addition to saw blades they supply T rails for channelers, etc. Also manufacture galvanized iron useful to stone men for lining tanks.

BOOKS AND PERIODICALS.

The second annual edition of "Hendricks Architects' and Builders' Guide and Contractors' Directory of America" has been received. It contains over 150,000 names, addresses and business classifications comprising builders and contractors of material and construction in the building and kindred industries, with full list of manufacturers of and dealers in everything employed in the manufacture of and material and apparatus used in these industries from raw material to the manufactured aeticle and from the producer to the consumer. It is said to contain the most exhaustive and only accurate list of American architects. Published at $5.00 by S. E. Hendricks & Company, 44-46 Broadway, New York city.

The Trenton Iron Co., Trenton, N. J., have issued a book of 60 pages, bound in cloth descriptive of wire rope transportation in all its branches, and telling of the machines which they manufaeture. The descriptive text tells of wire-rope tramways, for transporting metals, stone or anything else of that character, quarry cableways, mine haulage plants and power transmission. This book is illustrated with numerous cuts of such machinery put in by them and now in successful operation in differents parts of the country. If any one is thinking of putting in any of the structures treated of in this volume it will pay him to secure a copy.

Unloading gravel trains by hand, when grading for railroads has always been an exceedingly slow, and, therefore, costly process. In countries like Russia, or China where human labor is cheap, such a system may be permissible, but in this country, where the laboring man is more and costs more than a machine such a way of working savors too much of lack of progress. The receipt of a forty page, illustrated pamphlet from the Lidgerwood Manufacturing Co. of New York indicates that the need has at last been met, and the practical application of the rapid unloader to the economical clearing of loaded cars proves that the expense for grading will now be reduced materially. The pamphlet contains twelve full page, and one double page half-tone illustrations from photographs taken of a rapid unloader in use on the Delaware & Hudson Canal company's railroad. It tells, too, all about the operation of the machine, and must be seen to be appreciated. The device is certainly a labor savor, and, therefore, curtails expenses, so that it will pay anyone interested to investigate the claims of the company before thinking all such work must be done by hand.

A rare fund of mechanical and decorative knowledge, particularly to the young artisan, is that contained in the *Operative Builder*, a comparatively new aspirant for the favor of those interested in the building trades, published by the Industrial Publishing Co., 22 College Place, N. Y. city. Its low price 50 cents per year should bring it many subscriptions from readers of STONE.

WORLD'S FAIR NOTES.

An interesting exhibit is to come from the Black Hills, S. D., which will display in novel form the minerals found in the Hills. The exhibit when arranged will be in the form of a two-story and a half cottage. The framework of the structure is already built, and is in the style of the Renaissance, with towers and numerous gables. It is impossible to decide on all details, of course, until all the material has been collected, but the following plan will be carried into effect as near as possible: The foundation will be made of pure white limestone headed with a layer of Buffalo Gap "calico" stone. The first story will be veneered white pink quartz. Above that the handsomest rock obtainable will be used—copper, mica, schist, needle, spar, garnet, etc. The lower part of the tower will be made of rubies and the under part with some sparkling substance. The windows and shingles are to be of mica and the steps of marble. The cottage will no doubt prove an attractive feature of the state exhibit.

Much apprehension has existed in the minds of many persons lest they should not be able to procure single specimens of the world's fair souvenir half dollar, except by paying exorbitant prices to speculators. The exposition could not sell except in quantities and the solution of the problem seemed difficult. The Hon. Thos. B. Bryan has solved it in a highly satisfactory manner. He has deposited with the treasurer of the exposition $5,000, and the same number of half dollars, as soon as minted, are to be delivered to the Jenning's Trust Company. Any stockholder of the exposition, on exhibition of his stock certificate and payment of the value, at the rate of one dollar for each, can receive one or more coins. These will be delivered in the order of the original application as filed. Applications should be made at once.

An exhibit of the Ice Age is being prepared in Ohio for the exposition by Prof. I. F. Wright. He will collect boulders from different parts of the state, and with them fragments from the original ledges in Canada from which the Ohio boulders were brought by the ice; and specimens of scratched stones; exhibit a large glacial map of Ohio, an outline map showing the course the boulders have been brought, placard detailing the principal glacial facts, etc.

The world's fair buildings will be dedicated on the 21st of October instead of the 12th, congress having passed a bill to that effect. October 21 is the exact anniversary of Columbus' landing, allowance being made for the correction in the calendar made by Pope Gregory. The change of date of dedication was made in the interest of chronological accuracy, and also to oblige New York City, which will have a Columbian celebration on October 12.

Indiana will make a fine display at the world's fair of the results of manufacturing industries growing out of the discovery of natural gas. Since Indiana first began to use the gas in 1885, it is claimed the growth of manufactures in the state has been greater than in any other state in the Union.

Information has been received that arrangements are being made in Paris to have the celebrated band of the Republican Guard and the Comedie Francaise actors attend the world's fair.

New York will have a large exhibit of interesting historical relics at the world's fair. Among them will be Washington relics, autographs of all the presidents, autographs of the signers of the declaration of independence and famous men of the revolutionary war; portraits of famous citizens of New York, including those of all the governors; model of Fulton's steamboat, and many other relics dating back to revolutionary times.

A model of ocean currents is to be exhibited at the world's fair which will possess great practical value. This model, which is a huge scientific tank, is made to represent the surface of the earth spread out on an area of about thirty feet square, the ocean and seas being shown by actual water. Small streams of water are ejected through pipes under the model so that the whole body of water moves exactly as the ocean currents move. The direction of the currents is shown distinctly by a white powder on the surface of the water. Near the model will be placed a large map giving the fullest details of the force, volume and direction of the various ocean currents.

DECAY OF STONE.

Stones of uniform texture commonly decay by disintegration at the surface, losing grain by grain in proportion to time and exposure. But they sometimes suffer a singular change, as if baked at the surface. An external enveloping crust is thus formed, as at Stonehenge, where the interior is soft but the exterior hard. This process appears to render such a stone durable, but if carried further, so as to produce a new texture of the surface, the external shell separates from the interior mass, desquamates and falls off, leaving a rough, soft inner core. This happens even to molded surfaces, like those of balusters. Stones composed of parts uneqnally mixed suffer unequal waste in different parts. Shell, corals, concretions and crystallized masses thus appear prominent from earthy limestones, and indicate the general fact that in proportion the force of molecular aggregation in the stone is the resistance which it offers to decay. Again, the circumstances under which a stone is exposed in a building influence its conservation. It is not the amount but the kind of exposure which governs the decay. The southern and western parts of our cathedrals yield, while the northen and eastern resist. Prominent cornices often are perfect, while below them the moldings are reduced to shreds. The drip-moldings remains and is even hardened, while the parts which it was destined to protect have mouldered away. —*The Architect.*

WHY THE SKY IS BLUE.

The explanation of the blue of the "vaulted canopy above us" is not to be sought in the fact that the air or its constituent particles reflect the readily refrangible rays of short-waved length and let the less refrangible long-waved rays through. The short waves of light—the blue color—are much more strongly reflected than the long-waved red ones. Lord Raleigh has proven the blue reflected in the light from the sky to be four-fifths times stronger than the yellow color and six-sevenths times stronger than the red. The violet is six-eighths times stronger than the yellow, or about nine-tenths times more intense than the long waves of red light. These relations of intensity must, therefore, cause the reflected light to appear to be mostly blue. The blue of the sky is also connected with the phenomenon known as the polarization of light, that color in the colored waves always being polarized in the same direction, which is quite independent of the nature of the turbid particles of the atmosphere. As long as present conditions exist the sky will be of blue colors of varying intensity.

COMPOSITION OF SOAPSTONE.

Talcum, or soapstone, also known as steatite, is a silicate of magnesium containing generally iron and other impurities. F. W. Clarke and E. A. Schneider have recently examined some talcum with the following results: The samples with which the experiments were carried out from Hunter's Mill, Virginia, and when dried in air gave the following analysis: Silica, 62.27 per cent.; alumina, 0.15 per cent.; ferric oxide, 0.95 per cent.; magnesia, 30.95 per cent.; ferrous oxide, 0.85 per cent.; maganous oxide, trace: water (lost at 105°), 0.07 per cent; loss on ignition, 4.84 per cent.; total, 100.08 per cent.; these figures agree closely with the empirical formula H_2-Mg_3 $Si._4$, O_{12}.

"STONE both surprises and pleases me. Send it to me right along."—*P. F. Coleman, Louisville, Ky.*

ORIGIN OF THE MATHEMATICAL SIGNS.

The sign of addition is derived from the initial letter of the word "plus." In making the capital letter it was made more and more carelessly until the top part of the "p" was finally placed near the center; hence the plus sign as we know it was gradually reached.

The sign of subtraction was derived from the word "minus." The word was first contracted in m, n, s, with a horizontal line above to indicate that some of the letters had been left out. At last the letters were omitted altogether, leaving only the short line.

The multiplication sign was obtained by changing the plus sign into the letter X. This was done because multiplication is but a shorter form of addition.

Division was formerly indicated by placing the dividend above a horizontal line and the divisor below. In order to save space in printing, the dividend was placed to the left and the divisor to the right. After years of "evolution" the two d's were omitted altogether and simple dots set in the place of each. As with the others the radical sign was derived from the initial letter of the word "radix."

The sign of equality was first used in the year 1557, by a sharp mathematician, who substituted it to avoid frequently repeating the words "equal to."

WHERE OIL STONES COME FROM.

Washita oil stone rock is crystallized silica. The crystals are very small, and are formed in clusters with point ends interlaced, leaving numerous cavities. These minute crystals are hexagonal in shape, with sharp points, and can be seen under a microscope, when magnified about 100 times. They are harder than steel, and that is why whetstones cut from this rock will wear away sharpen steel tools. Washita whetstones are called oil stones because oil must be used fill the cavities and float away the steel particles that are cut off the tools.

The peculiar geological formation from which these rocks are taken is not known to exist outside the state of Arkansas, where it occurs in many of the mountains of Saline, Hot Springs, Garland and Montgomery counties. These strata are in a vertical position, varying from nearly perpendicular to nearly horizontal, and have been considerably broken by upheaval or folding of the earth's crust.

CONSUMPTION OF IRON.

The consumption of iron ore in 1891 was about 1,760,000 gross tons less than in 1890, or 15,740,000 tons, against 17,500,000 in 1890. The decreased consumption in 1891 was borne chiefly by the production of domestic ore. The imports of iron ore in 1891 amounted to 912,864 gross tons, against 1,216,830 tons in 1890. The prices at which iron ore sold in 1891 were lower than in 1890. For 1892 they promise to be lower for some grades than in 1891.

RAILWAYS IN INDIA.

The length of railway communications open to traffic in India in March last was 16,890 miles, at the same time the length under construction was 1,684 miles. The corresponding figures in March last are 17,375 and 2,160. Thus during the twelve months 485 miles have been opened, and an additional 960 miles have been taken in hand. The construction of railways in India was commenced in October, 1850, and the date of the first opening to traffic was August, 1855. So, since the commencement of operations, there has been an average addition to the open mileage of about 420 a year.

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CONTRACT NEWS.

Fremont, O.—The congregation of the Grace Evangelical church will erect a new edifice at this place.

Elmwood, Mass.—The Board of School Trustees has had plans drawn for a public school-house.

Council Bluffs, Iowa.—H. H. Field invites sealed proposals for building a new school-house.

Chicopee Falls, Mass.—D. B. Briggs & Son have been awarded the contract to build a $27,000 hotel for A. F. Wildes.

Huntington Center, Conn.—Plans have been completed for a new Congregational church.

Lawrenceville, Va.—P. I. Bostick or L. H. Raney can give detailed information of a bank building to be erected here.

Belleville, Ill.—Plans and sketches will be received by the County Clerk of St. Clair county, Ill., at his office in the city of Belleville, up to Saturday, October 1, 1892, at 12 o'clock noon, for an addition to the south side of the court-house at Belleville, Ill. The cost of said addition, when finished, not to exceed the sum of $30,000.

Kirksville, Mo.—The congregation of the Catholic Church will build an edifice to have all modern church improvements.

Superior, Wis.—H. Hayes will build a business block at an estimated cost of $20,000.

Toledo, O.—The congregation of the Church of Our Father will have plans drawn for a new edifice at an estimated cost of $8,000.

Buffalo, N. Y.—Plans have been prepared for a new edifice for the congregation of St Andrew's Church.

Albert Lea, Minn.—Plans have been completed for a bank building for H. D. Brown.

Wellesley, Mass.—Warren A. Rodman, 54 Devonshire street, Boston, Mass., has completed plans for a school-house at an estimated cost of $30,000. No contracts have yet been let, and bids for the erection of the building are wanted

Wilkesbarre, Pa.—Leon Levy will build six residences after the plans of Thomas Podmore. The buildings will cost $25,000, and will be furnished with hot-air heating apparatus, electric bells, stained glass, mantels, grates, tiling and all conveniences.

Atlanta, Ga.—H. L. Woodruf, of Macon, Ga., has completed plans for an Odd Fellows' Orphans' Home. No contracts have been let as yet.

Birmingham, Ala.—The Methodist Episcopal congregation, of which Rev. Dr. Morrison is pastor, will erect a new edifice to have all modern church improvements.

Greenfield, O—S. Hannaford & Sons, of Cincinnati, O., have prepared plans for a store and office building for E. McClain. Estimated cost, $15,000.

Sealed proposals will be received at the office of the Supervising Architect, Washington, D. C., until 2 o'clock p. m. on the 4th day of October, 1892, for all the labor and materials required for the erection and completion, except plumbing and heating apparatus, of the extension to the United States court-house, postoffice, etc., building at Dallas, Texas.

Mulberry, Ind.—The directors of the Farmers' National Bank have had plans prepared for a bank building to have all improvements.

Middletown, Conn.—John H. Hulyer will build a hotel at this place.

New school-houses will be erected at Fond du Lac, Wis.; Newtown, N. Y.; Minneapolis, Minn., and West Mahanoy, Pa.

East Greenwich, R. I.—The common council has voted to appropriate $1,700 for alterations to be made to the school building.

Spartansburgh, Pa.—N. E. Morton will build a business block to have all conveniences.

St. Louis, Mo.—A. E. Cook, 714 Odd Fellows' Building, has prepared plans for a $20,000 residence for J. B. DesNeyers.

Muskegon, Mich.—W. J. Johnson, Temple Building, Chicago, Ill., has prepared plans for a residence to be built here at an estimated cost of $60,000.

Norwood, O.—Messrs. Drach & Thomas, architects, Louisville, have made plans for a residence for R. A. Basson; cost, $6,500.

Wheeling, W. Va.—The architects have made plans for the bank of Wheeling, which will be built on Main street.

NEW ENTERPRISES.

Chattanooga, Tenn.—The stockholders of the company which recently bought the brownstone mountain, near Graysville, met and elected the following officers: R. B. Hillas, president; B. L. Goulding, vice-president; W. P. D. Moross, secretary and treasurer. It is intended to at once have considerable of the stone quarried and placed in some of the new buildings in contemplation here. Samples of the beautiful stone will be sent to the leading architects of the country.

Newport, Ky.—Messrs. John J. Legner, John G. Quaing, Fred Guerlin, John Stant, James Baile, L. Newhouse and Julius Gross filed articles of incorporation of the Standard Contracting company in the county clerk's office. The general nature of the business is to be the construction of masonry, freestone and limestone work. The capital stock is $50,000 divided into shares of $100 each.

Manchester, Va.—Some of the best granite in Chesterfield—a county noted for good granite —is being quarried at the quarry recently opened on the farm of Mr. M. Stein, near Forest Hill Park.

Dover, Mass.—The stone quarry in the south part of the town is a valuable piece of property and will probably soon be developed as a permanent industry here. The quality of the granite is excellent. The present owner J. Q. A. Field, is an active, stirring man.

Cisco, Texas.—A specimen of brown marble was recently discovered near an old well on the ranch of M. B. Owen, near town, which was taken to the marble works here and polished. It was highly susceptible of polish yet almost as hard as granite, and an exceedingly fine speciman. Steps have been taken to ascertain the extent of the find and if satisfactory a quarry will be opened at once.

Buckstreet, N. H.—A new enterprise has just started in this vicinity, George P. Cofran 2d., having erected a building on the summit of Catamount and opened a steam quarry at that place. We wish him success in the enterprise.

Salt Lake City, Utah.—Articles of incorporation of the Bethesda Slate Quarry company were filed with County Clerk Allen. The life of the corporation is for fifty years. The capital stock is $100,000 in 20,000 shores of $5 each.

Milwaukee, Wis.—The village of Tigerton, Shawano county, is experiencing quite a boom at present. A Milwaukee company has purchased the granite quarry at that place and will open it on a large scale, employing 200 men. The citizens of the place have promised the company a bonus of $1,000.

Windsor, Vt.—Work on the granite quarries on Ascutney mountain is to be commenced at once. The fixtures for a blacksmith shop are now being put in place. The stone is of a green shade and of superior quality. Several Barre granite men are interested in the enterprise.

Bayfield, Minn.—The Bayfield Brownstone & Development company, of which R. D. Pike is general manager and in which the Drakes, of St. Paul, are largely interested, has recently taken several cores from a new ledge of rock showing a still finer quality of stone than any yet uncovered. It is entirely free from sand streaks and the grain is even finer than the celebrated island quarries. Investigation shows that the ledge has a depth of forty feet. This company has been organized for the purpose of dealing in and developing brownstone properties.

Concord, N. H.—The stockholders of the new granite company held a meeting. John M. Mitchell was elected temporary chairman and Wilfred Jacques temporary secretary. A committee of five consisting of L. Moynihan, W. Jacques, E. O. Callahan, William A. Thompson and C. K. George was appointed to draw up articles which will be submitted soon. The name of the Merrimack Valley Granite company was chosen.

Kansas City, Mo.—There is a quarry of lithograph stone near Plattsburg.

Gettysburg, Pa.—Frank Lightner is building a granite shop.

Watkins, N. Y.—D. H. Higgins has opened a new stone quarry near Cole Point, a short distance north of the old one. It is a very extensive one, and samples of the stone have been sent to Rochester and Philadelphia dealers who pronounce them sandstone of superior quality.

Lewiston, Me.—A granite quarry is being opened near Richmond village on Lancaster ledge The supply of granite is almost inexhaustible, and being within a few miles of the railroad station there seems to be every reason to hope that the quarry may become an important industry.

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In his most recent work on the steam engine, Professor Thurston says that the principles that must govern the engineer in his attempt to select the most efficient type of engine are as follows: (1) The greatest practical range of commercially economical expansive working of steam. The fluid must enter the cylinder at the highest admissible pressure, and must be expanded down to the minimum economical pressure at exhaust. (2) The wastes of heat must be made a minimum. All loss of heat by conduction and radiation from the engine must be prevented, if possible, and the usually much more serious waste which occurs within the engine, by transfer of heat from the steam side to the exhaust, by "cylinder-condensation" and re-evaporation, without doing its proportion of work, must be checked as completely as is practicable. This latter condition as well as commercial considerations, limits the degree of expansion allowable. It also dicates high speed of engine. (3) The largest amount of work must be done by the engine that it can perform, with due regard to the preceding conditions. This condition compels us to drive the engine up to the highest safe speed and to adopt the highest practicable mean steam pressure.

A distinguished professor has been testing a compound, three pounds of which sprinkled on a ton of coal is calculated to require 25 per cent. less coal to do certain work. He tested it on about 100 pounds of coal in a small boiler, doing very little work and proceeds to announce the results: That in one case the coal was saved by the compound, and in another case no saving was apparent. We would guarantee to make similar tests with wet and dry fuel and get the same results. A test to be a test should be of some length and with a boiler working under conditions favorable to getting the best economy from the coal. All that the tests proved was that the professor has some very inefficient boilers in his testing department.—*Boston Journal of Commerce.*

The owner of an upright boiler pointed out to us, a few days since, with considerable pride, a good feed-water heater he had put in to heat the feed from the exhaust steam. We believe in feed-water heaters and have had practical evidence of the saving they effect, so thought it was a good thing until the owner just then scoveidred the water was getting low and turned on the water through the heater, under city pressure. It took about two minutes to fill up that boiler, and we invited the owner to figure how much heat he got out of that exhaust steam in two minutes ten or twelve times a day. The way to make a heater pay is to use it all the time, feeding the water just fast enough to keep up the water line. Then the water goes slowly through the heater, gets pretty hot, and the exhaust steam has continually something to do.—*Boston Journal of Commerce.*

According to investigations conducted by Professor Rogers in Washington every pound of coal contains a dynamic force equal to the amount of work a man will do in one day. Three tons of coal represent the amount of work he could accomplish in twenty years, and a square mile of coal stratum only four feet thick represents as much work as a million laborers could accomplish in twenty years. Such calculations prove to us how wasteful are existing systems of combustion.

Many times little occurences come up in an engineer's practice where some kind of cement which will stand the heat and pressure of steam can be used to excellent advantage. Perhaps a blow hole in a casting opens up and a stream of steam or water escapes. In such a case it would be most desirable if there were some cement handy which could be put upon the defective spot and would set within a few moments and afterwards remain tight. Many other circumstances often come up where a good cement that would set solid and strong would be found most useful. To be sure, one of the best ways of fixing such things when they occur is to replace the defective by new material, but as this cannot always be done without the expenditure of more time and trouble than is convenient to give it something that will serve a good purpose instead is desired. A contemporary gives the following recipe for a preparation which, we think, will be found quite useful. Five pounds Paris white, five pounds yellow ochre, ten pounds litharge, five pounds red lead, four pounds black oxide manganese. The whole is to be well mixed and a little asbestos and boiled oil added. This cement will set hard in from two to five hours and is not subject to expansion and contraction to such an extent as to cause leakage afterwards.—*Stationary Engineer.*

DIRECTORY OF STONE, MARBLE AND GRANITE PRODUCERS.

To increase the present usefulness of STONE we append a classified list of Stone, Granite and Marble producers. This directory, when complete, will be a splendid reference guide for the use of architects and contractors. The annual subscription for STONE ($2) secures the *free use of one line during an entire year.* The insertion of a producer's name herein should not be dignified by the term "advertisement—although it is obvious that sales must result from the appearance of your name in a list circulated as this will be. A well-displayed advertisement in STONE will not only serve your purpose better than any other means you may adopt for keeping an announcement of your products before purchasers, but the Bulletin service given in connection therewith will be found splendid value for the amount invested. *Our Weekly Bulletin furnishes advertisers with intelligence regarding all projected work—railroad, public and private—and is mailed regularly every Wednesday from the office of* STONE. *Write for rates.*

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The Hoosier Stone Co., Bedford, Ind., (buff and blue oolitic.)
Peerless Stone Co., Bedford, Ind., (oolitic.)
*David Reed, 909 Chamber Commerce, Chicago, (buff and blue.)
*The Bedford Stone Quarries Co., Bedford, Ind., (buff and blue.)
Chicago and Bedford Stone Co., Bedford, Ind., (buff and blue.)
Naperville Stone Co., Naperville, Ill.
*Perry, Mathews & Buskirk, Bedford, Ind., (oolitic.)
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Meramec Highlands Co., 704 N. 2d-st., St. Louis, Mo.

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The Ohio Stone Co., 204 Superior street, Cleveland, O.
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*The Malone Stone Co., Cleveland, New York and Chicago.
Grafton Quarry Co., Grafton, Ill., and St. Louis, Mo.
*Buena Vista Freestone Co., Buena Vista, Ohio.
*Reitz & Co., Portsmouth, Ohio, (buff, blue and brown.
The Potsdam Red Sandstone Co., Potsdam, N. Y.
The Fish Stone Co., Columbus, O.
R. R. Peebles & Co., Henley, O.
John Rawle, 576 S. Mo-gan-st., Chicago, Ill.
The Weis Stone Co., Toledo, O.
Walker's Mills Quarry Co., Walker's Mills, Pa.
Forest City Stone Co., Cleveland, O.
W. H. Caine, Newburgh, O
The Constitution Stone Co., Constitution, O.
The Plymouth Stone Co., Plymouth, O.

GRANITE.

The Georgia-Quincy Granite Co., Exchange Building, Macon, Ga.
Booth Bros. & Hurricane Isle Granite Co., 60 Bank-st., New York City.
Roberts Bros., Penryn, Cal., blue and black granite.
John Beattie, Leetes Island, Conn., red granite.
*Southern Granite Co., Atlanta, Ga., and Cincinnati, O.
*Troy Granite Co, Worcester, Mass.
*Chas. Clements & Co., Boston and Chicago, Scotch and Swede.
*Davidson & Sons, Chicago and New York City.
Badger Bros., West Quincy, Mass
*R. C. Bowers Granite Co., Montpelier, Vt., Aberdeen, Scotland.
*J. G. Mott & Co., Joliet, Ill., red and gray.
*New York Granite Co., 67 W. 23rd st., New York City.
Holes Bros., St. Cloud. Minn., red and gray.
The Plymouth Granite Co., Reynolds' Bridge, Co n.
The New England G anite Works, Concord, N. H.
Maine Red Granite Co., Red Beach, Me.
The Millstone Granite Co., Niant'c, Conn.
Folsom Gr nite Co., 320 Sansome-st., San Franci co.
Mount Airy Granite Co., Greensboro, N. C.

BROWNSTONE.

Bodenschatz-Bedford Stone Co., 1140 Rookery, Chicago.
The Shaler & Hall Quarry Co., Portland, Conn., (brownstone.)
New England Brownstone Co., Cromwell, Conn., (brown freestone.
B. Beust & Co., New Albany, Ind., (Kyana brownstone.)
The Detroit & Hocking Valley R. and B. Co., Detroit, Mich.
*The Virginia Brownstone Co., 231 Hulbert block, Cincinnati, Ohio.
*Vernon Brownstone Co., 96 Washington-st., Chicago.
Duluth Brownstone Co., Duluth, Minn.
Iron Riv r Brownstone Co., Duluth, Minn
The Brainerd Quarry Co., Portland, Conn.
Killbuck Brownstone Co., Killbuck, O.
Carolina Brownstone Co., Raleigh, N. C.

SLATE.

*R. B. Pritchard, Middle Granville, N. Y., (red roofing.)
Scotch Hill Slate Works, Fair Haven, Vt., (purple stock.)
W. H. Hughes, Granville, N. Y., (roofing.)

MARBLE.

The Colorado Marble and Mining Co., Denver, Colo.
The Georgia Marble Co., Tate, Pickens, county, Ga.
F. P. Bagley & Co., 18th-st., Viaduct, Chicago
*D. H. Dickinson, 528-590 N. Water-st., Chicago.
*Vermont Marble Co., Proctor, Vt. (For branches see adv.)
*Davidson & Sons (Inc.), Chicago Watertown, N. Y., N. Y. City.
*R. C. Bowers Granite Co., Montpelier, Vt., (Italian.)
*True Blue Marble Co., West Rutland, Vt., (finest grades.)
T. M. Brady & Co., Canton, Georgia.
Inyo Marble Co., 137 Montgomery-st., San Francisco, Cal.
The Southern Marble Co., Marble Hill, Ga.
Marble Hill Quarry Co., 807 Penn Bldg., Pittsburgh, Pa.
Beaver Dam Marble Co., 704 Constitution-st., Baltimore.
LeGrand Quarry Co., Marshalltown, Iowa.
The Beaver Dam Marble Co., Baltimore, Md.

*See Advertisem nt in this issue.

PRICES CURRENT.

GRANITE.

(Rutland Granite Co., Rutland, Vt.)

No. 1 Bottom Bases—Per cubic foot.

(All 2.0 rise and under.)

Square...	5.0	5.6	6.0	6.6	7.0	7.6	8.0	8.6	9.0	9.6	10
	$ .85	90	1.00	1.10	1.20	1.30	1.40	1.55	1.70	1.85	2.00

No. 1 Second Bases, Plinths and Caps—Per cubic foot.

4.0	4.6	5.0	5.6	6.0	6.6	7.0	7.6	8.0	8.6	9.0	9.7	10
1.20	1.25	1.30	1.40	1.50	1.60	1.75	1.90	2.10	2.30	2.50	2.75	3.00

No. 1 Dies—Per cubic foot.

(Cubic feet and under.)

50	60	70	80	90	100	110	120	130	140	150	160
1.20	1.25	1.35	1.40	1.50	1.60	1.70	1.80	1.95	2.10	2.25	2.40

No. 1 Spires—Per cubic foot.

Ht	10	12	14	16	18	20	22	24	26	28	30	32
Sq	1.6	1.9	1.10	2.0	2.2	2.4	2.6	2.8	2.10	3.0	3.2	3.4
	$1.20	1.25	1.35	1.45	1.55	1.65	1.80	1.95	2.10	2.30	2.50	2.70

No. 1 Cemetery Coping—Per cubic foot.

10	12	14	16	18	20	feet long and under.
$1.20	1.25	1.36	1.50	1.65	1.80	

No. 1 Markers—Per superficial foot.

(8 inches in thickness and under.)

4	6	8.	10	superficial feet and under.
$ .50	.60	.75	.90	

No. 1 Posts—Per lineal foot.

(5 feet long and under.)

8	9	10	12	inches square and under.
$ .50	.60	.70	.80	

In ordering state for what purpose you want the stock, and we will select that best suited for your purpose.

Where price is made per cubic foot, no stone will be computed less than one foot in thickness.

Sarcophagus bases and caps to be reckoned at same price as square bases, having the same number of cubic feet, and of the same thickness.

For rockface bases and caps add 10 per cent.

For rockface dies—2 sides rockface, add 10 per cent: 3 sides, 15 per cent.; 4 sides, 20 per cent.; 5 sides, 30 per cent.

All claims for allowance or imperfections must be made within 15 days from receipt of stock, and no charge for work on defective stone will be allowed.

A discount of 5 per cent. will be given on full carload lots or more in one order; also same discount when part of the carload order is for True Blue marble or any other marble produced in this vicinity.

LIMESTONE.

DARK HOLLOW OOLITIC LIMESTONE—

(Bedford Steam Stone Works, Bedford, Ind.)

Random mill blocks, buff	25c	per cubic ft.
Dimension " "	30c	"
Random " blue	35c	"
Dimension " "	40c	"
Sawed slabs, buff, 4 in. thick and up	45c	"
" blue, 4 in. "	60c	"
Sawed sills, caps, etc., 4 sides sawed, buff	65c	"
" " " " blue	85c	"

Slabs broken to size, 5c extra per cubic foot.
Prices net, 30 days.

MARBLE.

(Vermont Marble Co., Proctor, Vt.)

SUTHERLAND FALLS MARBLE—

1891	Superficial.						
	1 in.	1¼ in.	1½ in.	2 in.	3 in.	4 in.	Monumental.
Mourning veins	50	62	85	90	1 35	1 80	5 50
No. 1	40	55	80	85	1 28	1 70	5 00
Average	35	45	60	65	98	1 30	4 00
No. 2	25	30	40	45	68	90	3 00
Best No. 3	20	25	33	35	53	70	2 50
No. 3	18	22	25	25	37	50	2 00

No. 3 Base Strips and Posts, per cubic ft.	$1 50
Inferior No. 3, Posts and Strips, per cubic foot	1 25
Inferior No. 3 Bottom Bases	1 25
Footstones, 5 to 8 inches wide, 2 inches thick	20
Footstones, sawed heads, each	22
Footstones, sawed heads, sand rub, box, each	28
Hearths, 1 inch, sawed edges, per sup. ft	20
Markers 10 to 14 in. long, 4 inches thick each	50
do 10 to 14 " " 3 " " "	35
do 16 to 18 " " 4 " " "	1 00
do 16 to 18 " " 3 " " "	75

RUTLAND MARBLE—

1891	Superficial						Cu
	1 in.	1¼ in.	1½ in	2 in.	3 in.	4 in.	Monumental
Statuary	90	1 15	Same as 2 inch.	1 40	2 10	2 80	9 00
No. 1	75	90		1 15	1 70	2 30	7 50
Average	60	70		85	1 25	1 70	6 00
No. 2 and Light Rut. Ital	43	48		65	1 00	1 30	4 75
Rutland Italian	33	38		60	90	1 20	4 25
Mottled Smith	...	......		45	67	90	4 00
Best No. 3	30	35		40	60	80	3 50
No. 3	23	26		30	45	60	2 25
Extra dark and mottled blue	40	50		60	90	1 20	4 50
Dark blue	30	35		50	75	1 00	3 50
Light blue	20	25		30	45	60	2 50

MOUNTAIN DARK MARBLE—

1891	Superficial.					Cu.
	⅞ in.	1¼ in.	2 in	3 in.	4 in.	Monumental.
No 1	50	70	1 00	1 50	2 00	5 50
Average	40	60	80	1 20	1 60	4 50
No. 2	32	45	60	90	1 20	3 50
No. 3	22	30	45	68	90	2 50

Inferior No. 3, Bottom Bases, per cu. ft.	$1 75
Inferior No. 3, Strips and Posts, per cu. ft.	1 75
Markers, 10 to 14 inches long, 3 inches thick, each	35
do 10 to 14 " " 4 " " "	50
do 16 to 18 " " 3 " " "	75
do 16 to 18 " " 4 " " "	100

URN LIST—In Rutland, Sutherland Falls, Mountain Dark and Italian.

Hight in Inches	Diam. of Bowl.	Rutland Average, S. F., M. V. Mount Dk.	R'tl'd No. 2 ex. dk blue Sutherland Falls No. 1 Mountain Dark Av.	Rutland Mottled S. Rutland Dk. Blue. Sutherland Falls Av. Mountain Dark No 2.	Rutland Best No. 3 Sutherland Falls No. 2	Rutland Light Blue. Suth'l'd F. Best No. 3. M. Dk. No. 3.
7	4	2 60	2 50	2 40	2 30	2 20
8	5	2 80	2 90	2 60	2 50	2 40
9	5	3 00	2 90	2 80	2 70	2 60
10	5	3 ,0	3 10	3 00	2 90	2 80
10	6	3 60	3 40	3 20	3 10	3 00
12	6	4 10	3 90	3 70	3 50	3 40
13	6	4 30	4 10	3 90	3 70	3 50
14	6	4 60	4 30	4 00	3 80	3 60
12	7	4 90	4 60	4 30	4 10	3 90
13	7	5 10	4 80	4 50	4 30	4 10
14	7	5 40	5 00	4 70	4 40	4 20
15	7	5 60	5 20	4 90	4 60	4 40
16	7	5 80	5 40	5 10	4 80	4 60
14	8	6 70	6 20	5 80	5 40	5 20
15	8	7 00	6 40	6 00	5 50	5 30
16	8	7 20	6 60	6 20	5 70	5 40
18	8	7 60	7 00	6 50	6 00	5 60
16	9	8 30	7 60	7 00	6 50	6 10
17	9	8 70	7 90	7 20	6 70	6 20
18	9	9 00	8 20	7 50	7 00	6 50
10	9	9 70	8 80	8 10	7 40	6 90
28	10	10 60	9 60	8 70	8 00	7 40
20	10	11 40	10 30	9 40	8 60	7 90
22	10	12 20	11 30	10 00	9 10	8 50
24	10	13 00	11 70	10 60	9 60	8 80
20	11	13 70	12 40	11 30	10 30	9 50
22	11	14 50	13 10	11 90	10 80	10 00
24	11	15 40	13 80	12 50	11 30	10 40
20	12	15 90	14 30	13 00	11 80	10 90
22	12	16 80	15 10	13 60	12 30	11 30
24	12	17 80	15 90	14 30	12 90	11 80
26	12	18 70	16 70	15 00	13 40	12 20
28	12	19 70	17 50	15 60	14 00	12 70
24	13	20 20	18 00	16 10	14 50	13 20
26	13	21 50	19 10	17 00	15 20	13 80
28	13	22 80	20 20	18 00	16 10	14 60
24	13	24 60	22 00	19 80	17 90	16 40
28	13	28 00	25 00	22 40	20 20	18 50
30	13	29 50	26 50	23 70	21 30	19 50

Hearths, 1 in., sawed edges, per sup. foot.......$ 20
No. 3 Base strips and posts, cubic foot.......... 1 50
Inferior No. 3 posts and strips " 1 25
" No. 3 bottom bases " 1 25
" blue posts, strips and bottom bases........ 1 75
Markers 10 to 14 long, 4 inches thick, each.......... 75
" 10 to 14 long, 3 inches thick, each 50
Footstones, 5 to 8 in., each.......................... 20
" sawed heads, each 22
" " sand rub and box.......... 28

SPECIALS—

Diminished Dies, extra.........per cubic foot......... 50c
Strips ordered 7 ft. long and over, ex. " foot....... 50
Sawing edges slabs, 1 inch thick per superficial ft. 03
" " " 2 " " " 05
" " " 3 " " " 08
" " " 4 " " " 10

Charges for sawing ends of slabs the same as for sawing edges.

Rutland Headstones, ordered with sawed edges, will be charged extra as above.

SAND RUBBING—

Monumental Stock...............per cubic foot......... 35c
Slabs, 2, 3 and 4 inch, rubbed sides, per surface foot.......................... 05
Slabs ordered rubbed edges, extra per 2 inch superficial foot.......................... 05
Hearths...............per surface foot rubbed.......... 05

BRANCHES—

Boston Marble Co., 8 Thacher-st.
Philadelphia Marble Co., 201 South 30th-st.
Vermont Marble Co., 265 Merwin-st. (Cleve. Br.)
Vermont Marble Co., 278 Woodbridge-st. West. (Det. Br.)
Vermont Marble Co., E. End Mich.-st. (Chicago Br.)
Vermont Marble Co., 1115 So. 7th-st. (St. Louis Br.)
Vt. M. Co. 244 Brannan St (San Francisco Branch)
Vermont Marble Co., 35 Hancock Pl. (N. Y. Br.)

BLUE MARBLE—

[True Blue Marble Co., West Rutland, Vt.]

1891.	Superficial in.							Monuments.
	7/8	1	1 1/4	1 1/2	2	3		
Dark Veined Blue..................	20	23	35	45	45	......	......	2 50
Dark Mottled Blue..................	30	35	40	55	55	......	......	3 50
Ex. Dk. Veined Blue..................	30	35	40	55	55	......	......	3 50
Ex. Dk. Mottled Blue..................	40	45	55	70	70	......	......	4 50

Dark blue posts, per cubic foot..........................$1 50
Dark blue bottom bases..............per cubic foot........ 1 65
Rutland inferior No. 3 bottom bases per cubic foot .. 1 25
Dark blue markers, 0.10 to 1.2 long, 3 in. thick each.. 50
Dark blue markers, 0.10 to 1.2 long, 4 in. thick, each 75
Dark blue foot stones, 5 to 8 in wide, assorted sizes each 15
Dark blue foot stones, same sizes, sawed heads, each. 22
Diminished dies, extra....................cubic foot.......... 50
Sand rubbing..........................per cubic foot. 35
Boxing.......................... " " 25

QUARRY SUPPLIES

PATENT CHILLED IRON GLOBULES.—

(B. C. & R. A. Tilghman, Philadelphia, Pa.)

Until further notice, our Patent Chilled Iron Shot will be supplied f. o. b. cars or boat in Philadelphia in 100-lb. bags at the following rates per pound:

No. (8-10)..................	4 1/2	No. (30-40)..................	3 1/2
" (10-12)..................	4 1/2	" (40-50)..................	3 1/2
" (12-14)..................	4 1/2	" (40 60)..................	3 1/2
" (14-22)..................	4 1/2	" (50-60)..................	3 1/2
" (22-40)..................	4 1/2	" (60..................	3 1/2

Finer grades supplied to order at special rates.

When so ordered, bags will be boxed for increased security, at 20 cts. each extra; in which case we will insure safe delivery of same.

Half and Quarter Bags sent only by express.

All transportation at cost and risk of consignee.

Terms:—Cash.

Discount on Spot Cash Orders of 5 bags.........3 per cent.
" " " 10 " ....5 "
" " " 20 " ....7 "

CRUSHED STEEL—

(Pittsburgh Crushed Steel Co., Limited.)

New Price List, Oct. 1, 1891.

Crushed Steel—

Sizes Nos.—12, 14, 16, 18, 20, 30, 40, 50, 60, 70.

Steel Emery—

Sizes Nos.—60, 70, 90, 150. F., F. F., F. F. Extra.

Original packages 100-pound bags.

Quantities less than 100 pounds..........................10c net
" " 720 " .... 8 1/2 "

Parties ordering at one times

720 lbs are charged	$60,	this is	20%	off on regular price.	
1,760	"	120,	"	30 1/3	" "
3,360	"	240,	"	40	" "
5,700	"	400,	"	42 1/2	" "
15,400	"	1,000,	"	54	" "

Above prices refer to orders for one shipment.
Terms net cash f. o. b.

WIRE ROPE—

(A. Leschen & Sons Rope Co., St. Louis.)

		Discount
Steel "Hercules"..........................	45	per ct.
Steel..........................	45	"
Gal. Iron..........................	45	"
Iron..........................	45	"
Wire Rope Blocks..........................	30	"
(Washburn & Moen M'f'g. Co.)		Discount
Iron..........................	45	per ct.
Steel..........................	45	"
Gal. Iron..........................	45	"

BLASTING MATERIAL.—

[For Customers of the Ingersoll-Sergeant Rock Drill Co. only]

Magneto-Electric Blasting Machine, "Crescent" C $25.00
" " " "Crescent" D 50.00

Platinum Fuzes—Cotton Covered.
(50 in a bundle.)

4 feet, wires..........................per 10		3.00
6 " "	"	3.54
8 " "	"	4.08
10 " "	"	4.62
12 " "	"	5.16
14 " "	"	5.70
16 " "	"	6.24
18 " "	"	6.78
20 " "	"	7.32

Fuzes with longer wires at the rates of 1/2 of one cent, per foot, additional—a double cover being necessary for long fuses.

Leading Wire, Cotton Covered..................1 c. per foot
Connecting Wire, Cotton Covered..............40 c. per lb.

VICTOR ELECTRIC FUSES.—

[Improved Water-proof Insulation.]
(James Macbeth & Co., 128 Maiden Lane, N. Y.)

	Single Strength. Ordinary Quality. Equal to Quintuple Force. PER 100	Double Strength. Extra Quality. Equal to Double Quintuple Force PER 100.
4 feet wires	$3.00	$3.75
6 "	3.54	4.29
8 "	4.08	4.83
10 "	4.62	5.37
12 "	5.16	5.91
14 "	5.70	6.45
16 "	6.24	6.99
18 "	6.78	7.53
20 "	7.32	8.07
22 "	8.32	9.07
24 "	9.32	10.07
26 "	10.32	11.07
28 "	11.32	12.07
30 "	12.32	13.07

VICTOR BLASTING MACHINES.

No. 1 will fire 5 to 8 holes.......................... $ 15.00

"PULL UP" BLASTING MACHINES—

No. 3 will fire 20 to 30 holes..........................$ 25.00
No. 4 " 40 to 50 holes.......................... 50.00
No. 5 " 75 to 100 holes 75.00
Standard Electric Fuse and Blast Tester $15.00
Victor Leading Wire Reel 4.00
Connecting Wire Holder.......................... 2.00
Battery Testing Lamp with Stand 3.50
" " " without Stand 1.75
Connecting Wire (on 2, 5 and 10 lb. Spools) 40c. per lb.
Leading Wire (measured to exact length ordered 1c per ft
Leading Wire (in large coils)..........................40c. per lb
Insulating Tape (half lb. packages)..............$1.50 per lb.
Packing cases charged for at cost.

RED SANDSTONE.

(The Portage Redstone Company, Chicago.)

[All quotations f. o. b. quarry, except otherwise mentioned.]

	Cu. ft.
No. 1 at Chicago..........................	$ .90
No. 2 "	.80
No. 1 at Cleveland..........................	.85
No "	.75

/—Stone.

MONUMENTAL NOTES.

The number of Columbus monuments in process of erection or to be erected in this country this year, is much too large to undertake to enumerate. New York will have three or four, and numerous other cities and towns will add a monument of one style or another to their art treasures. The designs are as various as the locations and when all are completed it will be a collection of Columbian memorials which will outnumber the memorials of any other man.

The Gettysburg battlefield is becoming well covered with soldiers' monuments erected by different regiments and corps engaged there. The sixteenth Vermont regiment dedicated its monument Sept., 23, and other smaller ones were dedicated about the same time. All are artistic in design and represent the devotion of American soldiers.

Humboldt Park, Chicago, will soon have a monument of the great German scientist of natural history, Alexander von Humboldt. A life-size statue will be donated by F. J. Dewes. The west park commissioners will furnish the foundation and the statue will be ready for the unveiling ceremonies by the middle of October.

According to *La Semaine des Constructeurs*, the competition at Altorf for a monument to William Tell, which was without result last year, has just been decided. Hissling, the sculptor, represents Tell with crossbow upon his shoulder and holding his son by the hand. The hero is clothed in the ancient mountaineer costume of the canton of Uri, while bas-reliefs upon the pedestal represent the shooting of the apple. The leap of Tell from the vessel on the lake to the shore, the death of Gessler and the death of Tell himself at the brook of Schaechenbach. The cost of the monument is estimated at $30,000, and the restoration of the tower of Altorf, at the foot of which it is to be placed, will amount to $6,000 more.

The German-Americans at Milwaukee have decided upon the erection of a monument to commemorate the German-American element of population in this country. Rupert Schmid of San Francisco was the designer. To illustrate their culture the superstructure has a certain resemblance to an old fort in the Romanesque style. The shaft, carrying out the same idea, is constructed in the Gothic style, representing the artistic development and perfection achieved by Germans in architecture, and its adoption by this county as well as the world over. The monument is crowned with two figures, both of them more or less ideal. The erect figure of a Teuton in a defiant and yet protecting attitude pictures the old country extending its influences and protection over the young female figures seated at his feet. The feminine figure is nude, illustrating chastity, and the face is upturned in search of truth. The accessories are a lyre, signifying harmony and poetry, the oil lamp, illustrating purity. The panels are covered with allegorical sculptures and around the base are portraits of great Germans. The whole monument is one of great power and beauty.

A mass meeting was called by Dr. George W. Bryant at the A. M. E. Metropolitan Church in Washington, in favor of the erection of a monument commemorating the emancipation of the slaves of the United States and to be dedicated to the memory of the colored soldier. Rev. Dr. William Gray was elected chairman, Lincoln Valle Gray, secretary of the executive committee of Chicago, was elected secretary.

It is a mistake to suppose that there was, up to a short time ago, no monument to Columbus in the United States. There is a monumental shaft in Baltimore. It is obscurely placed and is inscribed "Chris. Columbus." It dates from 1784. It was erected by the French consul general, De Amamour, who, with some hundred or more French officers and soldiers, remained in Baltimore after the end of the Revolutionary war.

The members of the Burns Monument Association of Providence, R. I., are threatened with legal proceedings by W. Clark Noble, the sculptor. The association was formed over two years ago for the purpose of erecting a monument to the poet Burns. Noble's design was accepted and the sculptor, it is said, made a model of his statue without any order or contract and which has been on exhibition in Providence some time. The association was unable to raise the $15,000 necessary for the statue and the project was dropped. Hence the sculptor threatens to sue for the price of his model.

50,000 yards of earth will be removed the coming winter.

A. J. Shehan, the granite quarryman, put off in his quarry at Graniteville, Mo., the largest blast ever made west of the Mississippi river. The holes were put in 40 feet high, and were scattered along in a line of 100 feet. The result was that 160,00 cubic feet of granite were cut off the ledge, and all in one solid piece, without a seam or crack.

A large force is now busy at the quarry below Clyffeside, Ky., getting out rock for the street car bridges at Keys creek and the trestle work foundations at other points on the line.

The stone which is used in the government building at Atchison, is shipped from Cottonwood Falls, Kansas. The stones weigh several tons each, and two or three make a car load. About forty car loads have already been used in the building, and ten or fifteen more will be required.

Messrs. Terbell & Ridgeway, the bluestone firm of Port Jervis, N. Y., are building up a permanent and immense bluestone business. Aside from extensive Pond Eddy interests, they control 1,200 acres of bluestone tract and the four stone docks, offices, switches, etc., alongside the Port Jervis, Middletown & New York railroad. They have 40 men at work on this tract and the output is large.

Such has been the demand for roofing slate this fall that the stock at all the quarries in Easton, Pa., is so entirely cleaned out that it would be difficult to get 50 car loads at all the quarries put together, and every operator is compelled to refuse orders each day. The banks being clear, indications now are that the quarries will be worked during the winter to the fullest extent, if the weather will permit, so as to accumulate a stock for the opening of the spring season.

Bays & Jeffery, the well-known Portland contractors, have several men at work developing the blue sandstone quarry a couple of miles from Oakland Cal. The Multonomah county commissioners will be there in a few days to examine the stone and the extent of the quarry, and, if satisfactory, it will be used in the construction of the new county court house in Portland.

The Hallowell, Maine, Co-Operative Granite company, consisting of Joseph Archie, Philip Cary, William Tregembo, George Lord and four others, was organized a few days ago. They are already operating a large tract at the Archie quarry and will erect derricks and sheds on Wingate wharf. They have a contract for a large building in New York.

The first lot of granite from the Appleton quarry at Blanchard, Me., operated by Coyne & Smith, is of excellent quality. The Canadian Pacific Railway company used a large amount of it at the bridges at Brownville, Moosehead Lake, over the Kennebec and other places.

The Eaton Ind., Land and Improvement company, has issued its stock. It is announced that the company's stone quarries are now in full operation.

The prosperity of the granite business at Waterbury, Vt., continues. Mr. Blondin has nearly $25,000 worth of rough granite waiting to be cut, and all the orders he can fill. He contemplates the

enlargement of his business in the near future.

Capt. C. C. Toole and John McCarty of Bangor have evidently secured a valuable property in the red granite quarry lately acquired by them at Eagle Lake, Mount Desert, Me. The tract comprises four acres, and the entire formation is of a fine grained, richly colored red granite, which takes a fine polish and is adapted for the best class of ornamental building. A crew has been engaged in clearing up the surface and quarrying operations will begin soon. The quarry is on the main road to Bar Harbor, so that transportation to the water will be easy, and before long it is expected that shipments will begin. It is the intention of the proprietors to make a specialty of getting out building stone for use in New York and other large cities, where full colored red granite is now much in vogue for decorative purposes.

Henry Kuntz has opened a new slate quarry at Reading, Penn., and the machinery for operating it is being put in position. The quarry promises well.

The granite industry at Richmond, Va., is reported as recovering from the longest dull season in its history. Men have been idle considerable during the past few months, but now a brighter outlook prevails and business seems likely to revive.

Terrytown, Penn., has good building stone quarries operated by J. B. Horton. The business done there now is large and increasing.

The idle granite quarry at Green's Landing, Me., has been bought by L. Williams who will begin work there immediately.

The Metropolitan stone quarry, Salt Lake City, Utah, is driven to its utmost capacity to keep up with the demands for building stone for use in the city. The demand is evidence of the value of the stone and the liveliness of building.

H. G. Williams, of Seattle, Wash., announces a discovery of slate in British Columbia, on Jervis inlet, 100 miles from Vancouver. The situation is such that the stone can be easily worked, and the fact that the grain is even is an important point in favor of opening the quarry immediately. The slate is admirably adapted to all sorts of useful and ornamental work.

The Ashland Brownstone company, Ashland, Wis., is shipping its products to St. Louis to be used in building. Superintendent Ward says that the stone gains friends every day.

A superior quality of soapstone has been discovered on Catalina island, near Riverside, Cal. The stone is extensively used throughout the East as a wall finish, but not much on the west coast on account of its cost. But since this discovery, it is stated that the public can be supplied with home product at a cost which will not exceed that of an ordinary hard-finish, and have an article on their walls which is acknowledged by eastern plasterers to be superior to all hard finishes and to the eastern soapstone from Vermont, which is the best of the eastern product. The soapstone wall finish has many advantages over the ordinary lime or plaster of paris finish, as it is fire proof, can be washed at pleasure without injury, has a beautiful tint, and is invaluable not only in hospitals and physicians' offices, but for general wall finish, for the soapstone will absorb nothing, making houses plastered with it incapable of holding the germs of contagious disease.

The Frederick City, Md., Lim company

has been incorporated by Peter E. Bussard, Hamilton Lindsay, J. W. Gover and others. The company has secured forty acres of land underlaid with lime rock, and will erect kilns at once. The capital stock is $15,000.

A valuable slate deposit has been found along the Eastern and Northern railroad at Easton, Penn.

The Carlton, N. B., Red Granite works have moved to Calais, Me. The works have employed 200 men or more and New Brunswick people look upon it as a serious loss.

A stone quarry has been opened at the new yards of the Missouri, Kansas & Texas Railroad by McDonald & Penfield at Denison, Tex.

The American Red Stone Company, at their Pleasant Valley quarries, near Fort Collins, Colo., has started the first diamond saw ever operated west of Chicago The blade contains from $1,000 to $1,500 worth of natural diamond crystals.

Ten Colorado quarries produced in 1889 an output valued at $314,673. This came from six counties of the state, named as follows, in order of value of output: Douglas, $200,049; Clear Creek, $75,000; Gunnison, $25,000; and much smaller amounts from Chaffee, Larimer and Boulder counties. The great bulk of the product was used for general building purposes, a small amount being devoted to monumental and cemetery use, and a trifling quantity to street work. The counties producing granite are all in the central part of the state, running from the extreme northern limits to about half the distance to the southern boundary. The greater portion comes from counties in the neighborhood of Denver.

Business is booming at Brinton, Penn., quarries. Never in the history of the management has there been so many orders for serpentine stone. A large force of workmen are employed at the present time.

The Monarch slate quarry, Wind Gap, Penn., which has been idle nearly a year, is to be operated again. Owen X. Jones and Robert G. Roberts, of that place, and a man from Bangor are the lessees. The work of pumping the water out of the quarry was commenced at once.

Business in the granite quarries at Green's Landing, Me., was never more brisk than at present. Several new firms have opened quarries there, and these, with many of the local firms, will continue business through the winter reports the *Industrial Journal*.

Seventy-two cars of slate from the Imperial and Acme quarries, Wind Gap, Penn., were shipped over the Bangor & Portland road during the month of October. This is the largest shipment ever made over that road in one month.

The Monson Hillside Slate Company, recently organized in Portland, Me., are to commence operations at once at their quarry in Monson on what is known as the Burmah vein. The quarry was opened in 1890 by Andrew Jones and considerable slate of fine quality was manufactured. Additional buildings are going up and new machinery will begin to arrive this week.

A new granite quarry is being opened upon the Colby farm in Tunbridge, Vt., near the northwestern corner of the town, and quarrymen say the stone is very fine.

The Cheshire, Mass., Lime Manufacturing company has their new lime kiln nearly finished.

MONUMENTAL NOTES.

A committee composed veterans is soliciting funds for a soldiers' monument at Danville, Penn. The gentlemen are actively at work, under the direction of James Foster, of Danville, the chairman of the committee.

Work has been begun by the Prentice Brownstone company in getting out the Wisconsin monolith for the world's fair. The huge stone 115 feet long, is being taken from a layer of stone 70 feet below the surface and a number of feet below the level of the lake, at the Houghton quarry.

The foundation is started for a monument to William Ellery Channing, the great Unitarian. The monument is to be erected on Touro Park, at Providence, R. I., a few feet from the historic old stone mill, and facing the Channing Memorial Church. It is a gift to the city by a person whose name the sculptor refuses to make public.

A granite tombstone surmounted by an iron cross has been completed, and will be removed from Vladivostock, Alaska, this month to Bering sea island to mark the burial place of the bones of Captain Vitas Bering, after whom Bering sea is named. Subscriptions for the monument were made by the officers of the Russian Siberian squadron. Bering died on Bering island December 4, 1741. His grave was discovered last year by the crew of the Russian schooner Alert who accidentally found the pile of stones used as a marker.

The commissioners of Mower county, Minn., have appropriated $500 towards a soldiers' and sailors' monument to be located in the public square at Winona, Minn.

S. P. Frost is chairman and H. N. Beach secretary of an association at Brockport, N. Y., formed for the purpose of erecting a soldiers' monument there. It is proposed to build a monument 50 feet high on the most elevated spot in Brockport rural cemetery. The people in the vicinity are subscribing liberally for the fund required.

Members of the order of Knights of Pythias at Des Moines, Iowa, are raising a fund for the erection of a monument to John Van Valkenburg, past grand chancellor of Iowa and supreme past chancellor of the world, Knights of Pythias.

The Rev. Michael Ronan and the Rev. Michael O'Brien of Lowell, Mass., have each contributed $100 to a fund to erect a monument "to mark the place where the Christian religion took possession of this continent four hundred years ago," by the erection of its first church.

Irish-Americans in New York have begun the agitation of the question of the erection of a monument to the Irish patriot, Robert Emmett.

West Troy, N. Y. is raising money to defray the expense of building a monument to the memory of firemen of that town.

A new corporation at Davenport, Iowa, is the Volunteer Soldiers' Monument Association for the purpose of building a monument to Gen. John A. Logan and all the soldiers who served in the Rebellion.

The committee appointed for that purpose have begun the examination of designs submitted for a monument of Robert Burns which the Scotchmen of Pittsburg, Penn. propose to erect in Schenley Park, that city.

A public spirited citizen of Uxbridge,

Mass. has contributed $500 toward a soldiers' monument in that town, provided $5,000 can be raised.

A committee from the G. A. R. post at Northampton, Mass. has begun the canvass for $1,200 to be used in erecting a soldiers' monument there.

Shenandoah, Penn. is trying to secure money for a soldiers' monument there.

A subscription paper is being circulated for a proposed soldiers' monument at Glen Cove, N. Y.

Already discussion has begun regarding a suitable monument to the venerable poet Whittier. So far no definite action has been taken, but it is probable that an appropriate memorial will be built in Amesbury, Mass., for 52 years the poet's home.

It is probable that an Ashby monument association will be organized to erect a monument to Gen. Turner Ashby at Harrisonburg, Va.

The $125,000 fund to be used in the erection of a monument to commemorate emancipation and in honor of the soldiers and sailors of the negro race, is growing rapidly and the indications are that it will soon be raised. Few worthier objects have inspired gifts of gold for commemorative purposes-

America has been criticised for not having more monumental statues, more memorials to dead heroes, statesmen, philosophers, authors, artists and philanthropists. But such critics have always overlooked the two conditions necessary for a multiplication of statuary and monumental art. One is an inherent artistic instinct in the people which shall cause them to desire such art, and another is a condition of leisure which allows enjoyment of art. The past ten years has proved that Americans have inherent artistic instincts which are as refined and strong as any nation on earth. The condition of leisure, however, has not yet been reached. And yet the rapid multiplication of statues and commemorative monuments all over the land indicate that an era of more general appreciation of such art is dawning, and that the people are taking advantage of every opportunity to add to their enjoyment in this direction, and coming generations will not be ashamed of what their predecessors accomplished even in this age of commercialism and strife for gold. The foundation is laid broad and deep and the superstructure which the artists of the future will rear will be as noble, and pure, and grand as the great artists of the Old World have reared in centuries.

Boston is noted for its senseless discussions of the location of public monuments. Now when $20,000 has been raised for a statue to John Boyle O'Reilly it is claimed that it can't be erected in the city on the ground that there are many more deserving, and that he is in "no sense a product of Boston." Some of the horrible caricatures called statues which now occupy valuable space in that city of culture might be removed and something artistic and modern put in their places.

Directory of Stone, Marble and Granite Producers.

To increase the present usefulness of STONE we append a classified list of Stone, Granite and Marble producers. This directory, when complete, will be a splendid reference guide for the use of architects and contractors. The annual subscription for STONE ($2) secures the *free use of one line during an entire year*. The insertion of a producer's name herein should not be dignified by the term "advertisement—although it is obvious that sales must result from the appearance of your name in a list circulated as this will be. A well-displayed advertisement in STONE will not only serve your purpose better than any other means you may adopt for keeping an announcement of your products before purchasers, but the Bulletin service given in connection therewith will be found splendid value for the amount invested. *Our Weekly Bulletin furnishes advertisers with intelligence regarding all projected work—railroad, public and private—and is mailed regularly every Wednesday from the office of* STONE. *Write for rates.*

LIMESTONE.

C. H. Carli, Stillwater, Minn.
Salem Stone and Lime Co., Louisville, Ky., (oolitic.)
Bienert & Whitley, Romona, Ind., (oolitic.)
Bodenschatz—Bedford Stone Co., 1140 Rookery, Chicago.
Big Creek Stone Co., Bloomington, Ind., (oolitic.)
The Hoosier Stone Co., Bedford, Ind., (buff and blue oolitic.)
Peerless Stone Co., Bedford, Ind., (oolitic.)
*David Reed, 909 Chamber Commerce, Chicago, (buff and blue.)
*The Bedford Stone Quarries Co., Bedford, Ind., (buff and blue.)
Chicago and Bedford Stone Co., Bedford, Ind., (buff and blue.)
Naperville Stone Co., Naperville, Ill.
*Perry, Mathews & Buskirk, Bedford, Ind., (oolitic.)
Sterrett & Brodix, 1101 Chamber of Commerce, Chicago.
Meramec Highlands Co., 704 N. 2d-st., St. Louis, Mo.

SANDSTONE.

Cleveland Stone Co., Cleveland, O.
The Ohio Stone Co., 204 Superior street, Cleveland, O.
*The Grafton Stone Co., Grafton, (blue and buff.)
*W. R. Smith & Son, Otway, O.
*The Malone Stone Co., Cleveland, New York and Chicago.
Grafton Quarry Co., Grafton, Ill., and St. Louis, Mo.
*Buena Vista Freestone Co., Buena Vista, Ohio.
*Reitz & Co., Portsmouth, Ohio, (buff, blue and brown.
The Potsdam Red Sandstone Co., Potsdam, N. Y.
The Fish Stone Co., Columbus, O.
R. R. Peebles & Co., Henley, O.
John Rawle, 576 S. Mo gan-st., Chicago, Ill.
The Weis Stone Co., Toledo, O.
Walker's Mills Quarry Co., Walker's Mills, Pa.
Forest City Stone Co, Cleveland, O.
W. H. Caine, Newburgh, O.
The Constitution Stone Co., Constitution, O.
The Plymouth Stone Co., Plymouth, O.
The Owen Sound Stone Quarrying & Construction Co., Owen Sound, Canada.

GRANITE.

The Georgia-Quincy Granite Co., Exchange Building, Macon, Ga.
Booth Bros. & Hurricane Isle Granite Co., 60 Bank st., New York City.
Roberts Bros., Penryn, Cal., blue and black granite.
John Beattie, Leetes Island, Conn., red granite.
*Southern Granite Co., Atlanta, Ga., and Cincinnati, O.
*Troy Granite Co, Worcester, Mass.
*Chas. Clements & Co., Boston and Chicago, Scotch and Swede.
*Davidson & Sons, Chicago and New York City.
Fred E. Yorke, (carver,) Belvidere, N. J.
Badger Bros., West Quincy, Mass
*R. C. Bowers Granite Co., Montpelier, Vt., Aberdeen, Scotland.
*J. G. Mott & Co., Joliet, Ill., red and gray.
*New York Granite Co., 67 W. 23rd st., New York City.
Holes Bros., St. Cloud, Minn., red and gray.
The Plymouth Granite Co., Reynolds' Bridge, Conn.
The New England Granite Works, Concord, N. H.
Maine Red Granite Co., Red Beach, Me.
The Millstone Granite Co., Niantic, Conn.
Folsom Granite Co., 320 Sansome-st., San Francisco.
Mount Airy Granite Co., Greensboro, N. C.
John S. Braddock, (light gray and dark blue.) 316 W. Markham-st., Little Rock, Ark.

BROWNSTONE.

Bodenschatz-Bedford Stone Co., 1140 Rookery, Chicago.
The Shaler & Hall Quarry Co., Portland, Conn., (brownstone.)
New England Brownstone Co., Cromwell, Conn., (brown freestone.
B. Beust & Co., New Albany, Ind., (Kyana brownstone.)
The Detroit & Hocking Valley R. and B. Co., Detroit Mich.
*The Virginia Brownstone Co., 231 Hulbert block, Cincinnati, Ohio.
*Vernon Brownstone Co., 96 Washington-st., Chicago.
Duluth Brownstone Co., Duluth, Minn.
Iron Riv.r Brownstone Co., Duluth, Minn.
The Brainerd Quarry Co., Portland, Conn.
Killbuck Brownstone Co., Killbuck, O.
Carolina Brownstone Co., Raleigh, N. C.

SLATE.

*R. B. Pritchard, Middle Granville, N. Y., (red roofing.)
Scotch Hill Slate Works, Fair Haven, Vt., (purple stock.)
W. H. Hughes, Granville, N. Y., (roofing.)

MARBLE.

The Colorado Marble and Mining Co., Denver, Colo.
The Georgia Marble Co., Tate, Pickens, county, Ga.
F. P. Bagley & Co., 18th-st., Viaduct, Chicago
*D. H. Dickinson, 528-500 N. Water-st., Chicago.
*Vermont Marble Co., Proctor, Vt. (For branches see adv.)
*Davidson & Sons (Inc.), Chicago Watertown, N. Y., N. Y. City.
*R. C. Bowers Granite Co., Montpelier, Vt., (Italian.)
*True Blue Marble Co., West Rutland, Vt., (finest grades.)
T. M. Brady & Co., Canton, Georgia.
Inyo Marble Co., 137 Montgomery-st., San Francisco, Cal.
The Southern Marble Co., Marble Hill, Ga.
Marble Hill Quarry Co., 807 Penn Bldg., Pittsburgh, Pa.
Beaver Dam Marble Co., 704 Constitution-st., Baltimore.
LeGrand Quarry Co., Marshalltown, Iowa.
The Beaver Dam Marble Co, Baltimore, Md.

*See Advertisement in this issue.

PRICES CURRENT.

MARBLE.

(Vermont Marble Co., Proctor, Vt.)

SUTHERLAND FALLS MARBLE—

1892	Superficial. 1 in.	1¼ in.	1½ in.	2 in.	3 in.	4 in.	Monumental.
Mourning veins	50	62	85	90	1 35	1 80	5 50
No. 1	40	55	80	85	1 28	1 70	5 00
Average	35	45	60	65	98	1 30	4 00
No 2	25	30	40	45	68	90	3 00
Best No. 3	20	25	33	35	53	70	2 50
No. 3	18	22	25	25	37	50	2 00

No. 3 Base Strips and Posts, per cubic ft. $1 50
Inferior No. 3, Posts and Strips, per cubic foot 1 25
Inferior No. 3 Bottom Bases 1 25
Footstones, 5 to 8 inches wide, 2 inches thick 20
Footstones, sawed heads, each 22
Footstones, sawed heads, sand rub, box, each 28
Hearths, 1 inch, sawed edges, per sup. ft 20
Markers 10 to 14 in. long, 4 inches thick each 50
do 10 to 14 " " 3 " " " 35
do 16 to 18 " " 4 " " " 1 00
do 16 to 18 " " 3 " " " 75

URN LIST—In Rutland, Sutherland Falls, Mountain Dark and Italian.

Hight in Inches	Diam. of Bowl.	Rutland Average. S. F., M. V. Mount Dk.	R'tl'd No. 2 ex. dk blue Sutherland Falls No. 1 Mountain Dark Av.	Rutland Mottled S. Rutland Dk. Blue. Sutherland Falls Av. Mountain Dark No 2.	Rutland Best No. 3 Sutherland Falls No. 2	Rutland Light Blue. Suth'l'd F. Best No. 3 M. Dk. No. 3.
7	4	2 60	2 50	2 40	2 30	2 20
8	5	2 80	2 90	2 60	2 50	2 40
9	5	3 00	2 90	2 80	2 70	2 60
10	5	3 20	3 10	3 00	2 90	2 80
10	6	3 60	3 40	3 20	3 10	3 00
12	6	4 10	3 90	3 70	3 50	3 40
13	6	4 30	4 10	3 90	3 70	3 50
14	6	4 60	4 30	4 00	3 80	3 60
12	7	4 90	4 60	4 30	4 10	3 90
13	7	5 10	4 80	4 50	4 30	4 10
14	7	5 40	5 00	4 70	4 40	4 20
15	7	5 60	5 20	4 90	4 60	4 40
16	7	5 80	5 40	5 10	4 80	4 60
14	8	6 70	6 20	5 80	5 40	5 20
15	8	7 00	6 40	6 00	5 50	5 30
16	8	7 20	6 60	6 20	5 70	5 40
18	8	7 60	7 00	6 50	6 00	5 60
16	9	8 30	7 60	7 00	6 50	6 10
17	9	8 70	7 90	7 20	6 70	6 20
18	9	9 00	8 20	7 50	7 00	6 50
10	9	9 70	8 80	8 10	7 40	6 90
28	10	10 60	9 60	8 70	8 00	7 40
20	10	11 40	10 30	9 40	8 60	7 90
22	10	12 20	11 30	10 00	9 10	8 50
24	10	13 00	11 70	10 60	9 60	8 80
20	11	13 70	12 40	11 30	10 30	9 50
22	11	14 50	13 10	11 90	10 80	10 00
24	11	15 40	13 80	12 50	11 30	10 40
20	12	15 90	14 30	13 00	11 80	10 90
22	12	16 80	15 10	13 60	12 30	11 30
24	12	17 80	15 90	14 30	12 90	11 80
26	12	18 70	16 70	15 00	13 40	12 20
28	12	19 70	17 50	15 60	14 00	12 70
24	13	20 20	18 00	16 10	14 50	13 20
26	13	21 50	19 10	17 00	15 20	13 80
28	13	22 80	20 20	18 00	16 10	14 60
24	14	24 60	22 00	19 80	17 90	16 40
28	14	28 00	25 00	22 40	20 20	18 50
30	14	29 50	26 50	23 70	21 30	19 50

Hearths, 1 in., sawed edges, per sup. foot $ 20
No. 3 Base strips and posts, cubic foot 1 50
Inferior No. 3 posts and strips " 1 25
" No. 3 bottom bases " 1 25
" blue posts, strips and bottom bases 1 75
Markers 10 to 14 long, 4 inches thick, each 75
" 10 to 14 long, 3 inches thick, each 50

Footstones, 5 to 8 in., each 20
" sawed heads, each 22
" " sand rub and box 28

RUTLAND MARBLE—

1892	Superficial 1 in.	1¼ in.	1½ in.	2 in.	3 in.	4 in.	Cu Monumental
Statuary	90	1 15	Same as 2 inch	1 40	2 10	2 80	900
No. 1	75	90		1 15	1 70	2 30	750
Average	60	70		85	1 25	1 70	600
No. 2 and Light Rut. Ital	43	48		65	1 00	1 30	475
Rutland Italian	33	38		60	90	1 20	425
Mottled Smith	...	......		45	67	90	400
Best No. 3	30	35		40	60	80	350
No. 3	23	26		30	45	60	225
Extra dark and mottled blue	40	50		60	90	1 20	450
Dark blue	30	35		50	75	1 00	350
Light blue	20	25		30	45	60	250

MOUNTAIN DARK MARBLE—

1892	Superficial. ⅞ in	1¼ in.	2 in	3 in.	4 in.	Cu. Monumental.
No 1	50	70	1 00	1 50	2 00	5 50
Average	40	60	80	1 20	1 60	4 50
No 2	32	45	60	90	1 20	3 50
No. 3	22	30	45	68	90	2 50

Inferior No. 3, Bottom Bases, per cu. ft. $1 75
Inferior No 3, Strips and Posts, per cu. ft. 1 75
Markers, 10 to 14 inches long, 3 inches thick, each 35
do 10 to 14 " " 4 " " " 50
do 16 to 18 " " 3 " " " 75
do 16 to 18 " " 4 " " " 100

BLUE MARBLE—

[True Blue Marble Co., Rutland, Vt.]

1892	Superficial in. ⅞	1	1¼	1½	2	3		Monuments.
Dark Veined Blue	20	23	35	45	45	......	......	2 50
Dark Mottled Blue	30	35	40	55	55	......	......	3 50
Ex. Dk. Veined Blue	30	35	40	55	55	......	......	3 50
Ex. Dk. Mottled Blue	40	45	55	70	70	......	......	4 50

Dark blue posts, per cubic foot $1 50
Dark blue bottom bases per cubic foot 1 65
Rutland inferior No. 3 bottom bases per cubic foot 1 25
Dark blue markers, 0.10 to 1.2 long, 3 in. thick each 50
Dark blue markers, 0.10 to 1.2 long, 4 in. thick, each 75
Dk. Blue Markers, 16 to 18 in. long, 3 in. thick, each 75
Dk. blue markers, 16 to 18 in. long, 3 in. thick, each 75
Dk. blue markers, 16 to 18 in. long, 4 in. thick, each 1 00
Dark blue foot stones, 5 to 8 in wide, assorted sizes each 15
Same sizes, sawed heads, sand rubbed and boxed, each 18
Dk. blue ft. stones, 10 in. wide 2 in. thick, each 30
Same sizes, sawed heads, each 33
Same sizes, sawed heads, sand rubbed and boxed, each 42
Dk. blue foot stones, 5 to 8 in. wide, 3 in. thick, assorted sizes, each 25
Same sizes, sawed heads, each 28
Same sizes, sawed heads, sand rubbed and boxed, each 35
Dark blue foot stones, same sizes, sawed heads, each 22
Diminished dies, extra cubic foot 50
Sand rubbing per cubic foot. 35
Boxing " " 25

Sawing edges slabs, 1 inch thick per superficial ft. 03
" " " 2 " " " 05
" " " 3 " " " 08
" " " 4 " " " 10

Charges for sawing ends of slabs the same as for sawing edges.

Rutland Headstones, ordered with sawed edges, will be charged extra as above.

No. 1 Bottom Bases—Per cubic foot.

(All 2.0 rise and under.)

Square	5.0	5.6	6.0	6.6	7.0	7.6	8.0	8.6	9.0	9.6	10
	$ .85	90	1.00	1.10	1.20	1.30	1.40	1.55	1.70	1.85	2.00

No. 1 Second Bases, Plinths and Caps—Per cubic foot.

4 0	4.6	5.0	5.6	6.0	6.6	7.0	7.6	8.0	8.6	9.0	9.7	10
1.20	1.25	1.30	1.40	1.50	1.60	1.75	1.90	2.10	2.30	2.50	2.75	3.00

No. 1 Dies—Per cubic foot.

(Cubic feet and under.)

50	60	70	80	90	100	110	120	130	140	150	160
1.20	1.25	1.35	1.40	1.50	1.60	1.70	1.80	1.95	2.10	2.25	2.40

No. 1 Spires—Per cubic foot.

Ht 10	12	14	16	18	20	22	24	26	28	30	32
Sq 1.6	1.9	1.10	2.0	2.2	2.4	2.6	2.8	2.10	3.0	3.2	3.4
$1.20	1.25	1.35	1.45	1.55	1.65	1.80	1.95	2.10	2.30	2.50	2.70

No. 1 Cemetery Coping—Per cubic foot.

10	12	14	16	18	20	feet long and under.
$1.20	1.25	1.36	1.50	1.65	1.80	

No. 1 Markers—Per superficial foot.

(8 inches in thickness and under.)

4	6	8	10	superficial feet and under.
$ .50	.60	.75	.90	

No. 1 Posts—Per li ·eal foot.

(5 feet long and under.)

8	9	10	12	inches square and under.
$ .50	.60	.70	.80	

For rockface bases and caps add 10 per cent.

For rockface dies—2 sides rockface, add 10 per cent: 3 sides, 15 per cent.; 4 sides, 20 per cent.; 5 sides, 30 per cent.

LIMESTONE.

DARK HOLLOW OOLITIC LIMESTONE—

(Bedford Steam Stone Works, Bedford, Ind.)

Random mill blocke, buff ....25c per cubic ft.
Dimension " " .... 30c "
Random " blue.................. 35c "
Dimension " " ....40c "
Sawed slabs, buff, 4 in. thick and up .....45c "
" blue, 4 in. " ......60c "
Sawed sills, caps, etc., 4 sides sawed, buff 65c "
" " " " blue 85c "

Slabs broken to size, 5c extra per cubic foot.

Prices net, 30 days.

SPECIALS—

Diminished Dies, extra.........per cubic foot......... 50c
Strips ordered 7 ft. long and over, ex. " foot....... 50

SAND RUBBING—

Monumental Stock................per cubic foot......... 35c
Slabs, 2, 3 and 4 inch, rubbed sides, per surface foot.. 05
Slabs ordered rubbed edges, extra per 2 inch superficial foot.. 05
Hearths...............per surface foot rubbed........... 05

BRANCHES—

Boston Marble Co., 8 Thacher-st.
Philadelphia Marble Co., 201 South 30th-st.
Vermont Marble Co., 265 Merwin-st. (Cleve. Br.)
Vermont Marble Co., 278 Woodbridge-st. West. (Det. Br.)
Vermont Marble Co., E. End Mich.-st. (Chicago Br.)
Vermont Marble Co., 1115 So. 7th-st. (St. Louis Br.)
Vt. M. Co. 244 Brannan St (San Francisco Branch)
Vermont Marble Co., 35 Hancock Pl. (N. Y. Br.)

QUARRY SUPPLIES

PATENT CHILLED IRON GLOBULES.—

(B. C. & R. A. Tilghman, Philadelphia, Pa.)

Until further notice, our Patent Chilled Iron Shot will be supplied f. o. b. cars or boat in Philadelphia in 100-lb. bags at the following rates per pound:

No. (8-10)	4½	No. (30-40)	3½
" (10-12)	4½	" (40-50)	3½
" (12-14)	4½	" (40 60)	3½
" (14-22)	4½	" (50-60)	3½
" (22-40)	4½	" (60	3½

Finer grades supplied to order at special rates.

When so ordered, bags will be boxed for increased security, at 20 cts. each extra; in which case we will insure safe delivery of same.

Half and Quarter Bags sent only by express.

All transportation at cost and risk of consignee.

Terms:—Cash.

Discount on Spot Cash Orders of 5 bags.........3 per cent.
" " " 10 " ....5 "
" " " 20 " ....7 "

CRUSHED STEEL—

(Pittsburgh Crushed Steel Co., Limited.)

New Price List, Oct. 1, 1891.

Crushed Steel—
Sizes Nos.—12, 14, 16, 18, 20, 30, 40, 50, 60, 70.
Steel Emery—
Sizes Nos.—60, 70, 90, 150, F., F. F., F. F. Extra.

Original packages 100-pound bags.

ties less than 100 ....10c net
" " 720 " .... 8½ "

Parties ordering at one times

720 lbs are charged $60, this is 20% off on regular price.

1,760	"	120,	"	30½	"	"	
3,360	"	240,	"	40	"	"	
5,700	"	400,	"	42½	"	"	
15,400	"	1,000,	"	54	"	"	

Above prices refer to orders for one shipment.

Terms net cash f. o. b.

WIRE ROPE—

(A. Leschen & Sons Rope Co., St. Louis.)

		Discount
Steel "Hercules"	45	per ct.
Steel	45	"
Gal. Iron	45	"
Iron	45	"
Wire Rope Blocks	40	"

(Washburn & Moen M'f'g. Co.)

		Discount
Iron	45	per ct.
Steel	45	"
Gal. Iron	45	"

BLASTING MATERIAL.—

[For Customers of the Ingersoll-Sergeant Rock Drill Co. only]

Magneto-Electric Blasting Machine, "Crescent" C $25.00

Platinum Fuzes—Cotton Covered.

(50 in a bundle)

4 feet, wires		per 10	3.00
6 "	"	"	3.54
8 "	"	"	4.08
10 "	"	"	4.62
12 "	"	"	5.16
14 "	"	"	5.70
16 "	"	"	6.24
18 "	"	"	6.78
20 "	"	"	7.32

Fuzes with longer wires at the rates of ½ of one cent, per foot, additional—a double cover being necessary for long fuses.

Leading Wire, Cotton Covered...................1 c. per foot
Connecting Wire, Cotton Covered..............40 c. per lb.

VICTOR ELECTRIC FUSES.—

[Improved Water-proof Insulation.]

(James Macbeth & Co., 128 Maiden Lane, N. Y.)

		Single Strength. Ordinary Quality. Equal to Quintuple Force. PER 100	Double Strength. Extra Quality. Equal to Double Quintuple Force PER 100.
4 feet wires		$3.00	$3.75
6	"	3 54	4 29
8	"	4 08	4.83
10	"	4 62	5 37
12	"	5.16	5.91
14	"	5.70	6.45
16	"	6.24	6.99
18	"	6.78	7.53
20	"	7.32	8.07
22	"	8.32	9.07
24	"	9.32	10.07
26	"	10.32	11.07
28	"	11.32	12.07
30	"	12.32	13.07

VICTOR BLASTING MACHINES—

No. 1 will fire 5 to 8 holes..............................$ 15.00

"PULL UP" BLASTING MACHINES—

No. 3 will fire 20 to 30 holes..............................$ 25.00
No. 4 " 40 to 50 holes.............................. 50.00
No. 5 " 75 to 100 holes.............................. 75.00
Standard Electric Fuse and Blast Tester $15.00
Victor Leading Wire Reel 4.00
Connecting Wire Holder.............................. 2.00
Battery Testing Lamp with Stand 3.50
" " " without Stand 1.75
Connecting Wire (on 2, 5 and 10 lb. Spools) 40c. per lb.
Leading Wire (measured to exact length ordered 1c per ft
Leading Wire (in large coils)..........................40c. per lb
Insulating Tape (half lb. packages)..............$1.50 per lb

Packing cases charged for at cost.

RED SANDSTONE.

(The Portage Redstone Company, Chicago.)

[All quotations f. o. b. quarry, except otherwise mentioned.]

	Cu. ft.
No 1 at Chicago	$ 90
No. 2 "	.80
No. 1 at Cleveland	.85
No "	.75